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ABSTRACT

The impacts of the Maryland State Performance Assessment Program (MSPAP) and the Maryland Learning Outcomes (MLOs) on curriculum, classroom instruction and assessment, professional development, and student learning were studied. Data sources were questionnaires completed by principals, mathematics teachers, and students from 90 elementary and middle schools and a review of mathematics classroom instruction, assessment, and test preparation activities. Most principals and teachers indicated that they were moderately or very familiar with the purpose, content, and format of the MSPAP, and most were familiar with the MLOs. Most students, who represented two "on" years (grades 5 and 8) and two "off" years (grades 4 and 7), indicated that they were familiar with the purposes of the MSPAP. The majority of principals and teachers indicated that both mathematics procedural knowledge and problem solving were assessed by the MSPAP to a moderate or great extent, and most felt that the emphasis was appropriate. The majority of teachers (82%) indicated that MSPAP had a moderate or great impact on their classroom activities, and that this impact increased over the years. Most fifth and eighth grade students indicated that the use of MSPAP-like tasks in their instruction helped them answer the MSPAP tasks. Analyses of student performance over time showed significant differences in MSPAP school performance in 1997 and in MSPAP gains from 1993 to 1997. Findings also show that schools for which teachers reported that MSPAP had greater influence on their instruction had greater MSPAP performance gains. Five appendixes contain additional information about MSPAP results. (Contains 80 tables and 28 references.) (SLD)

MSPAP Impact Study:

Volume I - Mathematics

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I. Executive Summary

The purpose of the study was to examine the impacts of the Maryland State Performance Assessment Program (MSPAP) and the Maryland Learning Outcomes (MLO's) on school curriculum, classroom instruction and assessment practices, professional development, and student learning. The data sources included questionnaires for principals, mathematics teachers, and students, and mathematics classroom instruction, assessment, and test preparation activities. Ninety elementary and middle schools in Maryland participated in the study during the 1996-97 year. Mathematics teachers in both the on-grades (3rd, 5th, and 8th) and off-grades (2nd, 4th, and 7th) participated in the study. Students in two of the on-grades (5th and 8th) and two of the off-grades (4th and 7th) responded to the student questionnaires.

Descriptive Results from the Questionnaires. Most of the principals (approximately 98%) and teachers (approximately 90%) indicated that they were moderately or very familiar with the purpose, content and format of MSPAP. The majority of the principals (93%) and teachers (66%) also indicated that they were moderately or very familiar with the MLO's. Further, the majority of the students indicated that they were familiar with the purpose of MSPAP (65%) and how the student responses to MSPAP are evaluated (57%). With respect to supporting MSPAP, the majority of the principals (approximately 86%) and teachers (approximately 68%) indicated that they somewhat or strongly supported MSPAP and that their support has increased over the years. The majority of the principals (79%) were supportive of holding schools accountable for meeting the performance standards on MSPAP, whereas, less than half of the teachers (37%) were supportive of using MSPAP for such purposes. However, the majority of both the principals (94%) and teachers (77%) indicated that MSPAP was a useful tool for making positive changes in instruction.

The majority of the principals and teachers indicated that both mathematical procedural knowledge and problem solving were assessed by MSPAP to a moderate or great extent and, in general, the majority of principals and teachers indicated that the emphasis was appropriate. However, more teachers indicated that the emphasis on problem solving (62%), as compared to procedural knowledge (42%), was appropriate. In addition, less than half (37%) of the on-grade (3rd, 5th, and 8th) teachers somewhat or strongly agreed with the statement that MSPAP tasks that assess mathematics are developmentally appropriate for students.

The majority of teachers indicated that MSPAP had a moderate or great impact on their classroom activities (82%) and that MSPAP's impact increased over the years (83%). Further, the majority of the teachers indicated that they place a moderate or great emphasis on the Maryland Learning Outcomes in their classroom activities (72%) and the emphasis has increased over the years (56%). Most of the

teachers (89%) indicated that they made a general improvement in their daily instruction to help students prepare for MSPAP. More importantly, teachers were in agreement more with the statement that they improved daily instruction than with any of the other test preparation activities. In addition, the majority of the 5th and 8th grade students (71%) indicated that the use of MSPAP-like tasks in their instruction helped them answer the MSPAP tasks that assess mathematics to a moderate or great extent.

With respect to professional development activities, the majority of the teachers indicated that MSPAP (approximately 75%) and the MLO's (56%) were addressed to a moderate or great extent in professional development activities. Further, the majority of the teachers indicated that they had a moderate or great amount of support and/or resources to enable them to make instruction (63%) and assessment (56%) changes to better reflect what is expected of students by MSPAP and the MLO's.

Statistical Results from the Questionnaires. Confirmatory factor analyses supported six dimensions underlying the teacher questionnaire: MSPAP familiarity, Support of MSPAP, Current Math Instruction (extent to which instruction reflects the learning outcomes and reform-oriented problem types), Change in Math Instruction (extent to which teachers have changed their instruction to focus on the learning outcomes and reform-oriented problem types), MSPAP's Impact on Instruction, and Professional Development Support related to MSPAP. Overall, teacher mean scores were at the upper end (favorable) of the score scale for each of these dimension. There were significant differences between grades for each of these dimensions except for the dimensions, Support MSPAP. In general, elementary on-grade teachers (3rd and 5th grades) were more favorable than middle school on- and off-grade teachers (7th and 8th) for these dimensions. However, the differences were relatively small.

Elementary and middle school principals responded similarly to the four dimensions underlying their questionnaires: MSPAP familiarity, Support MSPAP, MSPAP Impact, and Professional Development Support. Further, both elementary and middle school principals, as compared to elementary and middle school teachers of mathematics, indicated that they were more familiar with MSPAP, that they were more supportive of MSPAP, that MSPAP had a greater impact on classroom instruction, and that teachers were receiving more professional development support related to MSPAP.

Students in 4th, 5th, 7th, and 8th grade responded to some of the same questions as teachers regarding their current math instruction. Fifth grade students (classes), as compared to 7th and 8th grade classes, indicated that their instruction was more reflective of the learning outcomes and reform-oriented problem types. Further, 4th, 5th, 7th, and 8th grade teachers, as compared to their students, were more likely to indicate that their mathematics instruction had a grater emphasis on the learning outcomes and reform oriented problem types.

Descriptive Results from the Classroom Activities. The results from the analyses of the classroom activities indicate, to some extent, that teachers' assessment and instruction activities reflect the MLO's, and have some of the same characteristics as the MSPAP tasks. Approximately half of the classroom activities, to some extent, required problem solving and reasoning, were integrated with another subject area (primarily writing), and required the application of skills and knowledge to real life problems. Over 50% of the classroom activities required knowledge of numbers and operations, approximately 30% required geometry and/or measurement, and approximately 20% required statistics. The content outcome of probability, patterns and relationships, prealgebra and algebra were represented in less than 10% of the activities. However, algebra was represented more in 7th and 8th grade activities (17%-39%).

Over one-third of the activities required students to provide at least one written explanation, while approximately 15% required several explanations and were very similar in form to the MSPAP tasks. Slightly less than one-third of the assessment activities included multiple-choice items. As might be expected the MSPAP test preparation activities that teachers used were more similar to the MSPAP tasks than were the classroom instruction and assessment activities.

When differences across grade levels occurred with respect to the mathematics classroom activities, in most cases, they were in favor of the elementary school on-grades (3rd and 5th). As an example, a larger percentage of the 3rd and 5th grade mathematics classroom instruction activities required students to problem solve and/or reason as compared to the other grade levels (2nd, 4th, 7th and 8th).

MSPAP Performance Gains From 1993-97. The analyses of performance over time indicated, for the schools participating in this study, that there were significant differences in MSPAP school performance in 1997 and in MSPAP gains from 1993-97. In addition, the percent of students receiving free or reduced lunch (i.e., proxy for socio-economic status) was negatively related to MSPAP performance in 1997, but it was not significantly related to MSPAP performance gains from 1993-97. This indicates that although schools with high levels of percent free or reduced lunch performed poorer on MSPAP in 1997 than schools with low levels of percent free or reduced lunch, the schools have similar MSPAP mathematics performance gains regardless of the percent of students receiving free or reduced lunch. Lastly, higher levels of teacher-reported "MSPAP Influence on Instruction" were associated with higher levels of rate of change in MSPAP mathematics performance over time. Thus, the schools for which teachers reported that MSPAP had a greater influence on their instruction had greater MSPAP mathematics performance gains. It is important to note that the school sample size for this analysis was relatively small (n=86) and therefore, the results should be interpreted cautiously. Growth model analyses using larger data sets may provide more stable results than the analysis in this present study.

II. Objective

A number of states are implementing statewide assessment programs that depend heavily on performance-based assessments. These assessments are considered critical tools in the educational reform movement (Linn, 1993) and are being used for high-stakes purposes such as holding schools accountable to state standards. A prevailing assumption underlying performance-based assessments is that they serve as motivators in improving student achievement and learning, and that they encourage instructional strategies and techniques that foster reasoning, problem solving, and communication (Frederiksen & Collins, 1989; National Council on Education Standards and Testing, 1992).

Given these high expectations for performance-based assessments, the consequences of the uses and interpretations of the assessments need to be addressed, including both negative and positive consequences, intended and plausible unintended consequences (Messick, 1989, 1992; Cronbach, 1988; Koretz, Barron, Mitchell, & Stecher, 1996; Linn, Baker, & Dunbar, 1991). As stated by Linn (1994), "If the argument that validation should include an evaluation of the consequences of the uses and interpretations of assessment results is accepted, then it is not sufficient to provide evidence that the assessments are measuring the intended constructs. Evidence is also needed that the uses and interpretations are contributing to enhanced student achievement and at the same time, not producing unintended negative outcomes (p. 8)." Further, the consideration of potentially negative effects through the eyes of multiple stakepersons may help ensure a more comprehensive evaluation of the consequences (Cronbach, 1989).

The purpose of the study is to examine the impacts of the Maryland State Performance Assessment Program (MSPAP) and the Maryland Learning Outcomes (MLO's) on school curriculum, classroom instruction and assessment practices, student learning, professional development, and school decision-making policies. MSPAP is a performance assessment program for grades 3, 5, and 8 designed to measure school performance and provide information for school accountability and improvement so as to ensure quality education (Maryland State Board of Education, 1995). MSPAP was implemented in the earlier 1990's to assess student achievement and school performance with respect to the Maryland Learning Outcomes. MSPAP requires students to develop written responses to interdisciplinary tasks that require the application of skills and knowledge to real life problems. It is intended to promote performance-based instruction and classroom assessments.

This study examines the impact of MSPAP for the 1996-97 instructional year for the mathematics and language arts content areas in elementary and middle schools in Maryland. The schools were classified according to the percentage of students who were receiving a free or reduced lunch, which

served as a proxy for socioeconomic level, and according to the school's performance gains on MSPAP. The differences in the nature and the extent of the consequences of the assessment program for students in grade levels being tested, "on-grades" (3, 5, and 8), versus students in grade levels not being tested, "off-grades" (2, 4, and 7), were examined. If the intent of the assessment program is to improve student learning for all students regardless if they are being "tested", then it is necessary to examine the consequences for all students.

This report includes the results for the principal, teacher, and student mathematics questionnaires as well as the results from the analysis of the mathematics classroom materials that were provided by teachers. The last section of the report discusses the relationship among MSPAP school performance gains and several variables such as teacher reported impact of MSPAP on instruction, teacher reported professional development support, and % free or reduced lunch.

III. Data Source

School Sample

A stratified random sampling procedure was used to select the schools, with the strata being defined by three levels of each of the following: (a) percent free or reduced lunch according to the 1994-95 classification and (b) MSPAP performance gains (MSDE's 1993-95 change index). Schools were classified into one of the nine cells based on their rankings in the distributions for these two variables. Eight elementary schools from each of the nine cells were sampled and four middle schools from each of the nine cells were sampled. A total of 72 elementary and 36 middle schools were selected to participate in the study with alternate schools identified as potential replacements for schools who chose not to participate. A larger number of elementary schools were selected because, compared to the middle schools, they have fewer teachers per grade.

The final sample consisted of 59 elementary and 31 middle schools, with a total of 90 schools. Thus, the school participation rate was 82% for elementary schools and 86% for middle schools. There was an approximately equal number of schools within each of the nine classification cells[1]. Of the 59 elementary schools, 42 were from the initial 72 that were sampled, and of the 31 middle schools, 22 were from the initial 36 that were sampled. The remaining schools were from the list of alternate schools for each cell. This represents schools from 19 systems/counties in Maryland. It should be noted that, because schools were unable to be contacted until January 1997 regarding their participation in the study, the sample size for the 1996-97 instructional year was reduced.

Instruments

To triangulate on the consequences of MSPAP, multiple measures were used. The data sources used for this study were questionnaires and samples of classroom instruction and assessment materials. Questionnaires were developed for principals, teachers and students. The questionnaire for principals was the same for both elementary and middle school principals. Separate language arts and mathematics questionnaires were developed for 2nd, 3rd, 4th, 5th, 7th, and 8th grade teachers in those respective areas. The teacher questionnaires did not vary substantially across on- and off- grades (i.e., tested and

[1] The correlations between change indexes from consecutive years are close to zero; therefore, the cells in which the schools were classified changed when they were reclassified using the change index based on the 1995-96 year. Schools were reclassified once the 1995-96 data were available because that was the year in which the data were collected for this study. It should be noted, however, that once the schools were reclassified there was still approximately an equal number of schools in each cell.

not tested grades, respectively). Language arts and mathematics questionnaires were developed for students in 4th, 5th, 7th, and 8th grades. The questionnaires for the 4th and 7th grade (i.e., off-grade) students contained a MSPAP public release task so that the students could examine the task prior to responding to questions pertaining to MSPAP-like tasks.

The questionnaires consisted of both likert and constructed response items. Some of the likert items were in the form of questions, and others were statements. In general, a four-point scale was used for the likert items. To triangulate on the consequential evidence, students, teachers, and principals responded to similar questions for areas in which it was deemed appropriate. The areas on the teacher questionnaire included the following: familiarity with MSPAP, support for MSPAP, beliefs about MSPAP, overall impact of MSPAP, the nature of instruction and classroom assessments, MSPAP's impact on instruction and classroom assessments, the nature of professional development activities, and MSPAP's impact on professional development activities. The principal and student questionnaires included items for areas that were deemed appropriate. Some of the ideas for questions pertaining to the support for MSPAP and the beliefs about MSPAP were based on a previous study examining the consequential evidence of state assessments (Koretz, Mitchell, Baron, & Keith, 1996). The instruments were piloted in the spring of 1996 in schools in Maryland and were reviewed by Maryland mathematics teachers.

Data collection forms were developed for a subset of the teachers in both the off-grades (2nd, 4th, 7th) and on-grades (3rd, 5th, 8th) who provided classroom materials. Teachers were asked to provide 10 instruction tasks and 10 assessment tasks that were representative of their classroom materials across the school year. They were also asked to provide an example scoring scheme, and an example test preparation activity. The data collection forms asked teachers to indicated the nature of the students' ability levels for the mathematics class that the materials were used in. (e.g., heterogeneous ability group, homogeneous ability group, exclusively special education). The forms also asked teachers to indicate the nature of the mathematics taught in the class (e.g., general math, pre-algebra, algebra).

Data Collection

Teachers and principals were asked to complete their respective questionnaires during February 1997. Students were administered the student questionnaire within the two weeks following the administration of MSPAP, that is, in either the 3rd or 4th week of May 1997.

Teachers were asked to send in approximately 5 mathematics instruction activities, 5 mathematics assessment activities, and 1 sample of a scoring scheme used from September to December 1996. Similarly, in the spring they were asked to send in another set of 5 instruction activities, 5 assessment activities, and 1 sample of a scoring scheme used from January to June 1997. In addition, they were also

asked to send a sample of a MSPAP test preparation activity used prior to the administration of MSPAP. If the teacher taught more than one mathematics class, they were requested to obtain these materials from a typical class that they taught.

Questionnaire and Classroom Materials Return Rate

Principal and Teacher Questionnaire. A total of 86 of the 90 principals completed the principal questionnaire, resulting in a total response rate of 96%. A total of 1020 2nd, 3rd, 4th, 5th, 7th, and 8th grade teachers out of 1187 completed the teacher questionnaires, with a total response rate of 86%. Table III.1 indicates the return rates for principals, math teachers, and language arts teachers in elementary and middle schools.

Table III.1 Principal and Teacher Questionnaire Return Rate

	Completed Questionnaire		Return Rate
	Actual	Proposed	
Principals			
Total	86	90	96%
Elementary	58	59	98%
Middle	28	31	90%
Mathematics Teachers			
Total	515	594	87%
Elementary	353	405	87%
Middle	162	189	86%
Language Arts Teachers			
Total	505	593	85%
Elementary	321	372	86%
Middle	184	221	83%

Table III.2 provides the number of mathematics teachers and language arts teachers in each grade level who completed the questionnaires.

Table III.2 Number of Teachers at Each Grade Level who Completed the Questionnaire

	Grade					
	2nd	3rd	4th	5th	7th	8th
Mathematics Teachers	79	98	77	99	62	100
Language Arts Teachers	69	90	70	92	73	111

Student Questionnaire. Each of the 4th, 5th, 7th, and 8th grade teachers participating in the study were asked to administer the student questionnaire to one of their classes. Of the 637 classes that were identified for the administration of the language arts and mathematics student questionnaires, 443 classes completed and returned the student questionnaires, resulting in a return rate of 70%.

Overall, 115 of the 163 elementary classes (4th and 5th grades) that were identified for the administration of the mathematics student questionnaires actually administered the questionnaires, resulting in a return rate of 71%. In the middle school classes (7th and 8th grades), 95 of the 148 identified classes administered the mathematics questionnaires (64%). For the language arts questionnaires, 115 of the 156 identified elementary classes administered the questionnaires (74%), and 118 of the 170 identified middle school classes administered the questionnaires (69%). Table III.3 indicates the number of students and classes in 4th, 5th, 7th, and 8th grades who completed the mathematics questionnaires and the language arts questionnaires. It should be noted that each of the questionnaires were divided into 3 forms and a student only received one form. The forms were randomly distributed within each of the participating classrooms. This sampling design was used to reduce the amount of time taken away from instruction

Table III.3 Student Questionnaire Return Rate

	# of students	# of classes	# of students per form
Math Students			
4th	1076	48	359
5th	1442	67	481
7th	845	37	282
8th	1207	58	402
Language Arts Students			
4th	1197	54	399
5th	1291	61	430
7th	1201	53	400
8th	1358	65	453

Classroom Activities. A subset of schools were asked to participate in the collection of the classroom activities. Overall, 51 schools with a total of 704 teachers were asked to participate in this aspect of the study. Some or all of the teachers from 44 of the schools participated, resulting in a school participation rate for classroom activities of 86%. This represents schools from 15 different system/counties in Maryland. In these 44 schools, 529 of the teachers sent in all or a subset of the requested materials (75%). Of the 332 mathematics teachers that were asked to participate, 250 provided us with the materials (75%), and of the 372 language arts teachers that were asked to participate, 279 provided us with all or a subset of the materials (75%). More information is provided in the section "Description of Classes and Teachers Who Collected Classroom Activities".

IV. Description of Principals, Teachers, and Students

Principals and teachers responded to questions on the questionnaire regarding their experience, education, and gender. Students responded to questions regarding their gender and ethnicity.

Principals

Principals were asked to indicate the number of years they had served as a principal in their current school. As indicated in Table IV.1, a smaller percentage of middle school principals were new to the school (1 year or less) compared to elementary principals, 15% and 26% respectively. Also, 37% of the middle school principals were in the school more than 6 years, while only 26% of the elementary principals were in the school this long. When asked if they previously held another administrative position in the school, more middle school principals (41%) than elementary school principals (31%) indicated that they did.

Table IV.1 Number of Years as a Principal in the Current School

	Elementary (n=58)	Middle (n=28)
1 year or less	26%	15%
2-3 years	21%	22%
4-5 years	28%	26%
6-15 years	24%	33%
16-25 years	2%	4%
26 years or more	0%	0%

Principals also provided information regarding the total number of years they had served as an administrator in a Maryland elementary or middle school. As indicated in Table IV.2 below, a larger percentage of middle school principals have had more years of experience in Maryland schools than elementary principals. About 30% of middle school principals compared to 14% of elementary principals indicated more than 16 years as an administrator in Maryland.

Table IV.2 Number of Years as an Administrator in a Maryland Elementary or Middle School

	Elementary (n=58)	Middle (n=28)
1 year or less	7%	7%
2-3 years	5%	4%
4-5 years	16%	19%
6-15 years	59%	41%
16-25 years	14%	19%
26 years or more	0%	11%

Teachers

The majority of the teachers responding to the questionnaire were female. Across grades, 87% of the math teachers were female and 90% of the language arts teachers were female. In general, as the grade level increased, the percentage of male teachers increased slightly. For instance, about 21% of the middle school teachers responding to the mathematics questionnaire were male.

The percentage of mathematics and language arts teachers who were new to their current school (1 year or less) was 16% for all grades as indicated in Table IV.3. About 37% were in the school for 2 to 5 years, 29% were in the school for 6 to 15 years, and 19% were in the school more than 16 years or more. There were slightly more mathematics teachers who were new to the school (1 year or less) than language arts teachers. The percentages across grade levels were somewhat similar.

Table IV.3 Number of Years as a Teacher in the Current School

	All grades	2nd	3rd	4th	5th	7th	8th
1 year or less	16%	12%	13%	13%	17%	21%	16%
2-3 years	23%	17%	21%	26%	28%	24%	22%
4-5 years	14%	12%	16%	11%	14%	15%	15%
6-15 years	29%	36%	33%	28%	25%	22%	29%
16-25 years	15%	16%	13%	15%	13%	17%	17%
26 years or more	4%	7%	3%	7%	3%	1%	2%

Teachers also provided information regarding the total number of years they had taught in a Maryland school. The results for mathematics and language arts teachers were similar and are summarized in Table IV.4. An examination of the results at each grade level indicate slightly larger percentages of new teachers in the middle school grades.

Table IV.4 Number of Years as a Teacher in a Maryland Elementary or Middle School

	All grades	2nd	3rd	4th	5th	7th	8th
1 year or less	8%	6%	6%	6%	8%	11%	10%
2-3 years	15%	10%	18%	15%	18%	18%	12%
4-5 years	11%	9%	18%	10%	16%	8%	10%
6-15 years	29%	35%	10%	25%	23%	27%	31%
16-25 years	25%	24%	32%	27%	23%	24%	25%
26 years or more	12%	15%	24%	17%	11%	11%	11%

The vast majority of the mathematics and language arts teachers (98%) indicated that they were full-time teachers. Mathematics teachers were then asked to indicate whether they taught only math classes. Similarly, language arts teachers were asked to indicate whether they taught only language arts. As expected, there was a large difference among the grades as shown in Table IV.5. The majority of the middle school teachers taught only one subject, while the majority of the elementary school teachers taught more than one subject. Language arts teachers were also asked to indicate whether they taught reading and writing, reading only, or writing only. Nearly all the teachers (90%) indicated that they taught both reading and writing. The results were similar across all grade levels.

Table IV.5 Percentages of Teachers Indicating That They Taught Only Mathematics or Language Arts Classes

Mathematics Teachers	All grades	2nd	3rd	4th	5th	7th	8th
Teach only math	29%	3%	8%	7%	10%	77%	70%
Teach math and other subjects	72%	97%	92%	93%	90%	23%	30%
Language Arts Teachers							
Teach only language arts	36%	12%	13%	10%	20%	73%	76%
Teach language arts and other subjects	64%	88%	87%	90%	81%	28%	24%

Each teacher responded to one questionnaire that was specific to a subject area (mathematics or language arts) and a grade level (2, 3, 4, 5, 7, or 8). They were asked to indicate the number of "targeted" classes they taught. "Targeted" refers to classes in the subject area and grade level for which they received a questionnaire. Table IV.6 shows that the majority of the elementary teachers taught only

one "targeted" class, while a large percentage of middle school teachers, especially 7th grade teachers, taught 4 or more "targeted" classes (62% for 7th grade mathematics teachers and 58% of 7th grade language arts teachers).

Table IV.6 Percentages of Mathematics and Language Arts Teachers Indicating the Number of "Targeted" Classes Taught

Mathematics Teachers	All grades	2nd	3rd	4th	5th	7th	8th
1 class	67%	93%	90%	76%	68%	18%	26%
2-3 classes	19%	4%	7%	19%	26%	20%	29%
4 or more classes	21%	3%	2%	1%	6%	62%	45%
Language Arts Teachers							
1 class	51%	79%	78%	74%	58%	15%	17%
2-3 classes	23%	16%	13%	13%	32%	27%	32%
4 or more classes	23%	2%	5%	8%	10%	58%	49%

Mathematics and language arts teachers were asked to indicate the type of teaching certificate they hold. The majority of elementary teachers in both subject areas have an elementary education certificate, however the percentage is much smaller for middle school teachers as indicated in Table IV.7. About 44% of 7th grade mathematics teachers and 55% of 8th grade mathematics teachers have some type of secondary education certificate in mathematics. Likewise, about 56% of 7th grade language arts teachers and 58% of 8th grade language arts teachers have some type of secondary education certificate in language arts or English. The types of certificates included in the "other" category were special education, administration/supervision, and non-education content areas such as mathematics, science, etc.

Table IV.7 Type of Teaching Certificate Held by Mathematics and Language Arts Teachers

Mathematics Teachers	All grades	2nd	3rd	4th	5th	7th	8th
Early Childhood	12%	42%	11%	10%	4%	2%	3%
Elementary Education	70%	68%	85%	92%	90%	48%	33%
Secondary Education in Mathematics, 5-12	10%	0%	1%	0%	2%	29%	30%
Secondary Education in Mathematics, 7-12	7%	0%	1%	0%	1%	15%	25%
Secondary Education in another subject	5%	0%	3%	3%	2%	11%	12%
Other	18%	10%	12%	16%	18%	23%	27%
Language Arts Teachers							
Early Childhood	12%	35%	23%	9%	9%	0%	1%
Elementary Education	63%	74%	74%	90%	89%	29%	32%
Secondary Education in Language Arts/English, 5-12	15%	0%	2%	6%	4%	30%	37%
Secondary Education in Language Arts/English, 7-12	9%	0%	1%	3%	1%	26%	21%
Secondary Education in another subject	5%	0%	2%	1%	4%	11%	10%
Other	19%	13%	18%	19%	23%	16%	22%

Finally, mathematics and language arts teachers were asked to indicate whether they had ever been a Reader for MSPAP and if they had ever been on their School Improvement Team. Approximately 25% of the teachers indicated that they were served as a Reader for MSPAP on one or more occasions since 1992. Slightly more than 50% of the teachers indicated that they were on their School Improvement Team for at least one school year since 1992-93.

Students

Approximately 50% of the students responding to the mathematics and language arts questionnaires were female and 50% were male. This was similar across all grade levels. Students were also asked to indicate their ethnicity. As Table IV.8 shows, the majority of students (about 70%) indicated Caucasian, approximately 20% indicated African-American, and a very small percentage indicated Hispanic, Asian American, or other.

Table IV.8 Ethnicity of Students Responding to the Questionnaire

Mathematics Students	All grades	4th	5th	7th	8th
White	70%	67%	65%	73%	75%
African-American	17%	16%	19%	17%	15%
Hispanic	4%	3%	4%	3%	4%
Asian-American	5%	7%	7%	3%	2%
Other	5%	7%	5%	4%	4%
Language Arts Students					
White	67%	69%	58%	72%	70%
African-American	21%	19%	27%	19%	19%
Hispanic	3%	2%	3%	2%	5%
Asian-American	3%	5%	5%	2%	2%
Other	5%	6%	7%	4%	4%

V. Descriptive Results from Principal, Teacher, and Student Mathematics Questionnaires

The results are provided in several sections: Familiarity with MSPAP, Support for MSPAP, Beliefs about MSPAP, and the Impact of MSPAP. For the section on the Impact of MSPAP, the results are further organized into the following sections: Overall Impact of MSPAP, Impact of MSPAP on Instruction and Classroom Assessment, and the Impact of MSPAP on Professional Development Activities. The results from the principal questionnaires are from all participating principals. However, the results from the teacher questionnaires are from those teachers who received a mathematics teacher questionnaire and the results from the student questionnaires are from those students who received a mathematics student questionnaire. The results from the language arts questionnaires are forthcoming.

Familiarity with MSPAP and Related Materials

Principals and teachers were asked to indicate the extent to which they were familiar with the Maryland Learning Outcomes (MLO's), Maryland Curriculum Framework, and various aspects of MSPAP, including the purpose of MSPAP, format of MSPAP tasks, content and skills assessed by MSPAP, how to prepare students for MSPAP, how to interpret and use MSPAP results to improve classroom instruction and assessment, and how to explain MSPAP results to students and/or parents. They were also asked to indicate their familiarity with several MSPAP-related materials and documents, including MSPAP public release tasks, Performance-Based School Improvement Exemplars, Teacher-to-Teacher Talk, Principal-to-Principal Talk, Scoring MSPAP: A Teacher's Guide, MSPAP Parent Handbook, and MSPAP: A Guide for Parents. Lastly, students were asked if they knew the purpose of MSPAP and if they knew what types of answers to math tasks on MSPAP would receive high scores.

Familiarity with the MLO's and Maryland Curriculum Framework

Most of the principals indicated that they had either a moderate amount or a great deal of familiarity with the Maryland Learning Outcomes (93%) and the Maryland Curriculum Framework (81%). Teachers indicated less familiarity than principals with the MLO's and the Maryland Curriculum Framework. The percentage of teachers that indicated they had either a moderate or a great extent of familiarity with the MLO's was 66% and with the Maryland Curriculum Framework it was 54%.

Middle school and elementary school principals reported similar levels of familiarity with the MLO's and Maryland Curriculum Framework. Teachers across grades also reported similar levels of familiarity with the Maryland Curriculum Framework. With respect to the MLO's, however, 74% of the 3rd and 5th grade teachers reported being familiar with the MLO's to a moderate or great extent, whereas teachers in the other grade-levels (2nd, 4th, 7th, and 8th) reported less familiarity. The 7th grade teachers reported the least amount of familiarity, with 45% indicating a moderate or great extent of familiarity.

Familiarity with MSPAP

Purpose, Format, and Content of MSPAP. With respect to the familiarity with MSPAP, nearly all the principals indicated that they had a moderate amount or a great deal of familiarity with the purpose of MSPAP (99%), the format of MSPAP tasks (99%), and the content and skills assessed by MSPAP (96%). In addition, most of the teachers indicated that they had a moderate or great extent of familiarity with the purpose of MSPAP (93%), the format of MSPAP tasks (90%), and the content and skills assessed by MSPAP (86%).

Preparing Students for MSPAP. Most of the principals indicated that they know how to prepare students for MSPAP to a moderate or great extent (98%). Similarly, 85% of the teachers indicated that they know how to prepare students for MSPAP to a moderate or a great extent.

MSPAP Materials and Publications. The majority of principals indicated that they had either a moderate or great extent of familiarity with MSPAP materials and publications. Depending upon the particular publication or set of materials, between 85% and 98% of the principals indicated a moderate or great deal of familiarity. Overall, a smaller percentage of teachers were familiar with the various MSPAP publications and related materials. Over half of the teachers were familiar with the MSPAP public release tasks (60%), MSPAP Performance-Based School Improvement Exemplars (56%), and MSPAP Teacher-to-Teacher Talk (62%). Whereas, less than half of the teachers were familiar with Scoring MSPAP: A Teacher's Guide (43%) , MSPAP Parent Handbook (33%), and MSPAP: A Guide for Parents (33%).

Results of MSPAP. With respect to the use of the MSPAP results, the majority of the principals indicated that, to a moderate or to a great extent, they know how to interpret and use MSPAP results to improve classroom instruction and assessment (92%), and how to explain MSPAP results to students and/or parents (91%). Teachers, however, reported less familiarity than principals with knowing how to interpret and use MSPAP results: 68% indicated that they had a moderate or a great extent of familiarity with interpreting and using MSPAP results to improve classroom instruction, and 53% indicated that

they had a moderate or a great extent of familiarity with explaining MSPAP results to students and/or parents.

Principals and teachers were also asked to indicate the format in which MSPAP results are shared with teachers in their school, whether it be results from the Maryland School Performance Reports, Proficiency Level and Participation Reports, Outcome Score and Scale Score Reports, locally developed MSPAP reports, or other types of reports. Table V.1 shows the percentages of principals and teachers who indicated the various formats used for informing teachers of MSPAP results.

Table V.1 Percentage of Principals and Teachers Indicating the Formats for Informing Teachers of MSPAP Results

Formats for Sharing MSPAP Results	Principals	Teachers
Teachers have the opportunity to see actual written reports	90%	52%
Principals or others provide written summaries of reports	85%	80%
Principals or others provide verbal summaries of reports	94%	78%
MSPAP results are not shared with teachers	1%	2%

Overall, principals and teachers indicated that teachers are aware of the results of MSPAP. Only 1% and 2%, respectively, reported that the MSPAP results are not shared with teachers. A large percentage of both principals and teachers indicated that the principal or someone else provides teachers with written and verbal summaries of MSPAP results. However, in terms of teachers seeing the "actual written reports", principals and teachers have differing views. Most of the principals (90%) said that teachers have the opportunity to see actual reports, while only half (52%) of the teachers reported being aware of the opportunity to see actual reports.

Differences Between Elementary and Middle School Principals. There were several differences between elementary and middle school principals' reported level of familiarity with MSPAP. Overall, the elementary school principals reported being more familiar than the middle school principals. The differences were the greatest for the following aspects of MSPAP:

1. Content and skills assessed by MSPAP:
   67% of elementary versus 37% of middle school principals were familiar to a "great extent".

2. MSPAP public release tasks:
   All elementary versus 81% of middle school principals were familiar to a "moderate" or "great extent".

3. MSPAP Performance Based School Improvement Exemplars:
   95% of elementary versus 74% of middle school principals were familiar to a "moderate" or "great extent".

4. Scoring MSPAP: A Teacher's Guide:
   53% of elementary versus 22% of middle school principals were familiar to a "great extent". Whereas, 10% of elementary and 26% of middle school principals were "not at all" familiar.

Differences Across Grade-Level Teachers. Teachers across grades tended to report similar levels of familiarity with respect to the purpose of MSPAP. However, differences by grade-level occurred for the other aspects of MSPAP. The 3rd and 5th grade teachers (elementary, on-grade) tended to be the most familiar with the format of MSPAP, content and skills assessed by MSPAP, and preparation of students for MSPAP. Over 90% of the 3rd and 5th grade teachers reported being familiar with these aspects to a moderate or great extent. Whereas, the 7th grade teachers tended to be the least familiar with these aspects of MSPAP. On average, about 70% of the 7th grade teachers reported a moderate or great deal of familiarity.

Differences between these grade levels were the greatest for the use of MSPAP results and documents related to MSPAP. Approximately 25% to 33% of the 7th grade teachers reported that to a moderate or great extent they were familiar with them, whereas 50% to 75% of the 3rd and 5th grade teachers reported this level of familiarity.

Student Familiarity with MSPAP

Students were asked if they knew why MSPAP was given to students. Overall, 65% of the students said "yes" and 35% said "no". However, there were differences in the responses between the off-grade students (grades 4 and 7) and the on-grade students (grades 5 and 8). A larger percentage of 5th and 8th grade students said they knew why MSPAP was given to students (approximately 72%) compared to about 54% of the 4th and 7th grade students. This question also asked students to explain why they think MSPAP is given to students if they answered "yes".

The 5th and 8th grade students were also asked if they knew what types of answers to math tasks on MSPAP would receive good grades. Overall, 57% said "yes" and 43% said "no". The percentage of 5th grade students who indicated "yes" was slightly larger than 8th grade (61% and 51%, respectively). Students were also asked to describe what types of responses would get good grades.

The 4th and 7th grade students were asked if they knew what types of math tasks were on MSPAP before they saw the MSPAP example task in their questionnaire. Overall, 40% of the students said "yes" and 60% said "no".

Support for MSPAP

Principals and teachers were asked to indicate the extent to which they support MSPAP overall, the extent to which they support using MSPAP results for accountability purposes, and the extent to which they support the use of MSPAP as a tool for instructional change.

Overall Support for MSPAP

Most of the principals indicated that they either somewhat or strongly support MSPAP (87%) and that they have become more supportive over the years (86%). Although the teachers' percentages are slightly smaller than the principals' percentages, the majority of elementary and middle school teachers indicated that they either somewhat or strongly support MSPAP (71%) and that they have become more supportive of MSPAP over the years (65%).

Principals and teachers were also asked whether they agreed with the statement that MSPAP results provide useful information for making inferences about school improvement. A larger percentage of principals, compared to teachers, reported that they somewhat or strongly agreed with this statement, 82% and 56% respectively. There were no differences in the percentages across grade levels nor between type of school.

Principals were also asked whether the School Improvement Team (SIT) uses information provided by MSPAP when setting forth goals for their schools and for helping improve the quality of instruction in their schools. Most of the elementary and middle school principals somewhat or strongly agreed (95% for both). However, a larger percentage of elementary principals, as compared to middle school principals, "strongly" agreed with the statement regarding the SIT using MSPAP information to help improve the quality of instruction in their schools (64% and 36%, respectively).

Use of MSPAP Results for Accountability Purposes

Table V.2 indicates the level of principal and teacher support for using MSPAP results for accountability purposes. Only the overall levels of support are included since the results were similar for elementary and middle school principals and also across grade-levels for teachers. As indicated in the table, principals, as compared to teachers, reported being more supportive of using MSPAP for accountability purposes. Although over half of the teachers somewhat or strongly support the reporting of MSPAP results, the majority of the teachers somewhat or strongly oppose holding schools accountable for meeting the performance standards on MSPAP, using MSPAP and other report card results for

identifying schools as eligible for reconstitution, and using MSPAP and other report card results for identifying schools as eligible for recognition or monetary rewards.

Table V.2 Percentage of Principals and Teachers who Support MSPAP for Accountability Purposes

	Strongly or Somewhat Support		Strongly or Somewhat Oppose	
	Principals	Teachers	Principals	Teachers
Reporting of MSPAP results	71%	53%	29%	47%
Holding schools accountable for meeting the performance standards on MSPAP	79%	37%	21%	67%
Using MSPAP and other report card results for identifying schools as eligible for reconstitution	54%	26%	46%	73%
Using MSPAP and other report card results for identifying schools as eligible for recognition or monetary rewards	68%	25%	33%	75%

MSPAP as a Tool for Instructional Change

As indicated in Table V.3, nearly all of the principals (94%) somewhat or strongly agreed with the statement that MSPAP is a useful tool for making positive changes in instruction, and 78% of the principals somewhat or strongly agreed with the statement that MSPAP is a useful tool for making positive changes in instruction for those teachers who are resistant to change. Elementary and middle school principals responded similarly to these questions.

Table V.3 Percentage of Principals and Teachers who Support MSPAP as a Tool for Instructional Change

	Strongly or Somewhat Support		Strongly or Somewhat Oppose	
	Principals	Teachers	Principals	Teachers
Useful tool for making positive changes in instruction	94%	77%	6%	23%
Useful tool for making positive changes in instruction for those teachers who are resistant to change	78%	57%	12%	43%

Teachers indicated that they were much more supportive of MSPAP for instructional purposes than for accountability purposes. The majority of the teachers (77%) somewhat or strongly agreed with the statement that MSPAP was a useful tool for making positive changes in their own instruction and 57% of the teachers somewhat or strongly agreed with the statement that MSPAP was a useful tool for making positive changes in instruction for those teachers who are resistant to change. Teachers across grades tended to respond similarly to questions regarding their support for MSPAP as an instructional tool.

Beliefs About MSPAP

Principals and teachers were asked questions regarding their beliefs about the thinking skills assessed by MSPAP, the developmental appropriateness of MSPAP, the feasibility of meeting MSPAP standards, and the factors that affect MSPAP results. Teachers and students were asked questions regarding their beliefs about MSPAP tasks, multiple-choice items, and the expected level of student performance on MSPAP.

Beliefs About the Skills Assessed by MSPAP

Principals and teachers were asked to indicate the extent to which they think MSPAP assesses mathematical procedures/factual knowledge and mathematical problem solving/reasoning. In addition, they were asked to indicate whether they think MSPAP should place more or less emphasis on these types of thinking skills. Overall results for principals and teachers are in Table V.4.

Table V.4 Percentages of Principals and Teachers Indicating Their Beliefs About the Thinking Skills MSPAP Assesses

Emphasis on Thinking Skills	Moderate Extent		Great Extent	
	Principals	Teachers	Principals	Teachers
Math procedures & factual knowledge	54%	76%	26%	14%
Math problem solving & reasoning	28%	28%	68%	51%

Appropriateness of MSPAP's Emphasis	Emphasis Is OK		Needs More Emphasis	
	Principals	Teachers	Principals	Teachers
Math procedures & factual knowledge	70%	42%	21%	33%
Math problem solving & reasoning	73%	62%	12%	12%

The majority of principals and teachers indicated that MSPAP assesses both of these types of skills to either a moderate or great extent. However, as shown in the table, a relatively large percentage of principals and teachers (68% and 51%, respectively) think that MSPAP assesses problem solving and reasoning to a great extent, whereas only 26% and 14% of principals and teachers think that MSPAP assesses procedures and factual knowledge to a great extent.

Approximately 70% of the principals indicated that the emphasis on the two types of thinking skills was appropriate. A smaller percentage of teachers felt this way, especially for the emphasis on procedures and factual knowledge. Approximately 42% of the teachers said the emphasis was appropriate, whereas 33% indicated that more emphasis was needed.

Differences Across Grade Levels. Elementary and middle school principals reported similar beliefs about the extent to which MSPAP assesses procedures and factual knowledge, but they tended to differ in terms of MSPAP's assessment of problem solving and reasoning. About 78% of elementary principals reported that MSPAP assesses problem solving and reasoning to a moderate or great extent, compared to only 54% of the middle school principals. In addition, fewer elementary (7%) than middle school principals (23%) reported that MSPAP should place more emphasis on problem solving and reasoning.

There were no differences across grades for teachers with the exception of the percentage of teachers who selected the "don't know" option for these questions. A higher percentage of off-grade teachers (2, 4, 7) than on-grade teachers (3, 5, 8) reported that they did not know the extent to which either of these types of skills were assessed. For instance, almost 30% of the 2nd and 4th grade teachers said "don't know" compared to about 5% of the on-grade teachers. Thus, as might be expected, off-grade teachers have less familiarity with the types of skills assessed by MSPAP.

Beliefs About the Developmental Appropriateness of MSPAP

Principals and teachers were asked to indicate the extent to which they agree or disagree with the statement that the mathematics tasks on MSPAP are appropriate for students' ability levels. The elementary principals indicated the appropriateness of Grade 3 and Grade 5 MSPAP tasks and middle school principals indicated the appropriateness of Grade 8 MSPAP tasks. The 2nd and 3rd grade teachers indicated the appropriateness of Grade 3 MSPAP tasks, 4th and 5th grade teachers indicated the appropriateness of Grade 5 MSPAP tasks, and 7th and 8th grade teachers indicated the appropriateness of Grade 8 MSPAP tasks. The percentages in Table V.5 represent the combination of the "somewhat" and "strongly" agree categories.

Table V.5 Percentages of Principals and Teachers Indicating the Appropriateness of MSPAP Math Tasks for Students' Ability Levels

Appropriateness of MSPAP Math Tasks	Somewhat/Strongly Agree		
	Principals	Teachers	
Grade 3 Tasks	22%	2nd 50%	3rd 35%
Grade 5 Tasks	64%	4th 39%	5th 39%
Grade 8 Tasks	63%	7th 52%	8th 37%

As the results show, principals indicated that the 5th grade and 8th grade mathematics tasks on MSPAP were more aligned to the students' ability level than the 3rd grade tasks. In fact, 36% of the elementary principals strongly disagreed with the statement that 3rd grade MSPAP mathematics tasks were appropriate for 3rd grade students.

With respect to the teachers, there was little variation among on-grade teachers (3rd , 5th , 8th) across grades: the percentages agreeing that the ability levels of the math tasks on MSPAP are appropriate are between 35% and 39%. Compared to the principals' results, the percentages of teachers' indicating that the 5th and 8th grade MSPAP tasks were aligned to the students' ability level were smaller. Further, relatively larger percentages of 2nd and 7th grade teachers versus 3rd and 8th grade teachers indicated that the MSPAP mathematics tasks were appropriate for students' ability level. These results may be due to the off-grade teachers not being as familiar with MSPAP-like tasks as the on-grade teachers. This difference between off- and on-grade teachers was noted in some of the results described previously.

Beliefs about MSPAP Tasks and Multiple-Choice Items

MSPAP Tasks. Students and teachers were asked a set of four questions related to the mathematics tasks on MSPAP. The off-grade students (4th and 7th) examined a MSPAP public release task prior to answering the questions. Table V.6 shows the percentages of students and teachers across all grade levels who indicated either "moderately" or "very" for each of the questions. It should be noted that the teachers responded to the questionnaire prior to the administration of MSPAP, whereas the students responded after the administration of MSPAP.

Table V.6 Percentages of Students and Teachers Indicating Various Beliefs About MSPAP Tasks

Aspects of MSPAP Tasks	Moderately/Very	
	Students	Teachers
How interesting are the math tasks?	48%	56%
How well do they let you (your students) show what they know?	66%	48%
How important is for you (your students) to do well on MSPAP?**	89%	46%
How hard did you (your students) try to solve the math tasks?**	93%	61%

**The percentages in the table for these questions reflect the responses of 5th and 8th grade students only.

Similar results were found across the students and teachers in terms of how interesting they think the tasks are, but a larger percentage of students than teachers felt that the MSPAP tasks let them show what they know in math. The greatest difference between students and teachers occurred for the questions related to how important it is for students to do well and how hard students tried. Most of the students as compared to teachers indicated that it was important for them to do well and that they tried hard.

For each of these questions, differences occurred across grade levels. In some instances, the results differed for elementary versus middle grades and in other instances the differences were for off-grades versus on-grades. Further, between 10% and 24% of the off-grade teachers selected "don't know" for this set of questions which most likely indicates that the off-grade teachers are less familiar with the types of tasks on MSPAP and/or students' reactions to MSPAP. When comparing all the grades, the on-grade elementary students and teachers (3rd and 5th grade) had the largest percentages in the "moderately" and "very" categories, whereas the on-grade middle school students and teachers (8th grade) had the smallest percentages in these categories. Several differences for each question are summarized below.

1. How interesting are the math tasks for students?:
   58% of elementary students vs. 36% of middle school students indicated "moderately" or "very".
   14% of elementary students vs. 34% of middle school students indicated "not at all".
   There were no differences for teachers across grades.

2. How well do they let you (your students) show what they know?:
   50% of 8th grade students vs.73% of 4th, 5th, and 7th grade students indicated "moderately" or "very".
   33% of 8th grade teachers vs. 50% of all other teachers indicated "moderately" or "very".

3. How important is for you (your students) to do well on MSPAP?:
   79% of 5th grade students vs. 54% of 8th grade students indicated "very".
   58% of 3rd and 5th grade teachers vs. 29% of 8th grade teachers indicated "moderately" or "very".

4. How hard did you (your students) try to solve the math tasks?:
   76% of 5th grade students vs. 58% of 8th grade students indicated "very".
   71% of 3rd and 5th grade teachers vs. 38% of 8th grade teachers indicated "moderately" or "very".

The 4th, 5th, 7th, and 8th grade students were also asked to compare MSPAP-like tasks to multiple choice items with respect to a number of features. As shown in Table V.7, the majority of students indicated that multiple-choice items are more interesting and that it is easier to know what to do when working on multiple-choice items as indicated in the table below. They also indicated that they like multiple-choice items better than MSPAP-like tasks. However, the majority of students reported that MSPAP-like tasks make you think harder and that they are better at letting you show what you know. Thus, even though students may prefer multiple-choice items, perhaps because they perceive them as easier, students believe that MSPAP tasks assess their mathematical understanding better and that they require higher levels of thinking skills.

Table V.7 Percentage of Students Indicating Their Preference of Task Type

Features of Tasks	MSPAP	Multiple Choice	Same
More interesting	19%	60%	21%
Makes you think harder	83%	8%	9%
Easier to know what to do	10%	79%	12%
Better at letting you show what you know	67%	15%	18%
Like better	14%	72%	14%

Students across grade levels responded similarly for the questions regarding the type of task that makes students think harder, the type of task for which it is easier to know what to do, and the type of task that is the most interesting. However, the responses of elementary and middle school students differed in terms of the type of task they like better. Overall, a larger percentage of middle school students (7th and 8th) compared to elementary students (4th and 5th) indicated that they liked multiple-choice items better than MSPAP-like tasks, 82% vs. 65% respectively. For the question regarding the type of task that is better at letting students show what they know about math, a smaller percentage of 8th grade students (55%) compared to 4th, 5th, and 7th grade students (approximately 70%) said MSPAP.

Comparison of MSPAP to Standardized Multiple-Choice Tests. Mathematics teachers and principals were asked to indicate the extent to which they agreed with the following two statements: "There are advantages of MSPAP over standardized multiple-choice tests (e.g., CTBS).", and "There are advantages of standardized multiple-choice tests over MSPAP." Results showed that 77% of the mathematics teachers and 94% of the principals either somewhat or strongly agreed that there were advantages of MSPAP over standardized multiple-choice tests. Whereas, 66% of the mathematics teachers and 57% of the principals indicated that there are also advantages of standardized tests over MSPAP.

Teachers and principals were also asked to describe the advantages, if any, of each type of test. Of the 515 mathematics teachers who completed the questionnaire, 336 (or 65%) provided written comments for this item, and 59 out of the 86 principals (69%) provided written comments. Over half of the teachers and principals (55% and 53%, respectively) indicated at least one advantage of MSPAP and at least one advantage of standardized tests. About 25% of the teachers and 34% of the principals commented only on the advantages of MSPAP. About 19% of the teachers and 12% of the principals commented only on the advantages of standardized tests. Less than 1% of the teachers' and principals' comments were too vague to interpret. It should be noted that when asked to describe the advantages of standardized tests, the comments from teachers and principals were often worded in terms of the disadvantages of MSPAP.

On average, each teacher's and principal's response contained approximately 3 advantages of MSPAP and/or advantages of standardized tests. Table V.8 includes the most frequently cited advantages of MSPAP. The percentages in the table reflect the percent of total comments coded. For example, 17% of the stated advantages of MSPAP provided by teachers were that the test requires high-level thinking skills, and 16% of the stated advantages of MSPAP provided by principals were related to high-level thinking skills. This advantage was the one most frequently cited by both principals and teachers. Other frequent advantages cited by teachers were that MSPAP allows students to show what they know or are performance-based, assesses communication, and contains applied and realistic items or prepares students for the future. Examples of advantages of MSPAP cited by principals include less memorization of facts and procedures, contains applied and realistic items or prepares students for the future, and less chance of guessing correctly. As can be seen by the percentages in the table, the list of advantages was quite varied and accounts for approximately 80% of the total comments provided by teachers and principals. Several other advantages were noted less frequently such as allowing students to demonstrate their knowledge in different ways, more than one right answer to an item, integration across subject areas, and engaging and interesting items.

Table V.8 Advantages of MSPAP over Standardized Tests

Advantages of MSPAP	Percentage of Teachers' Comments	Percentage of Principals' Comments
Requires high-level thinking skills	17%	16%
Allows students to show what they know/performance-based	16%	10%
Assesses communication	12%	6%
Contains applied, realistic items/preparation for future/real-life	12%	14%
Less emphasis on memorization of facts and procedures	9%	15%
Less chance of guessing correctly	9%	8%
Includes cooperative learning	5%	5%

Table V.9 provides the teachers' and principals' responses when asked to describe the advantages of standardized tests. For the most part, the responses were worded in terms of the disadvantages of MSPAP rather than the advantages of standardized tests. Once again, the percentages in the table reflect the percent of total comments coded. For example, 13% of all the disadvantages of MSPAP provided by teachers and 9% of all the disadvantages provided by principals were that the scoring is either too difficult and time-consuming or that it is too subjective. The most frequently cited disadvantaged by principals was that individual scores are needed for student evaluations and comparisons across years or across schools. Some of the other disadvantages most frequently cited by both teachers and principals are that MSPAP removes the emphasis on basic skills, involves too much writing and/or reading, a week is too long for students and teachers to take a test, and results are not timely. The list in this table accounts for approximately 70% of all the disadvantages. Other types of disadvantages that were noted less frequently are that MSPAP is more stressful for students than standardized tests, it is too difficult for certain groups of students, it is not standardized or nationally normed, and it is too costly.

Table V.9 Disadvantages of MSPAP

Disadvantages of MSPAP	Percentage of Teachers' Comments	Percentage of Principals' Comments
Scoring is too difficult/subjective	13%	9%
Removes emphasis on basic skills	12%	11%
Individual scores are needed for student evaluation/comparisons	9%	16%
Doesn't show what student knows	8%	4%
Not a good format (multiple-choice is better)	8%	3%
Involves too much writing and/or reading	11%	5%
Week is too long for students and teachers for testing	6%	9%
Results are not timely	2%	8%
Not age-appropriate/too difficult	5%	4%

Beliefs About the Expected Level of Student Performance on MSPAP Mathematics Tasks

Students in 5th and 8th grade were asked to indicate whether they thought they performed at the excellent, satisfactory, or below satisfactory levels on the MSPAP mathematics tasks. Similarly, teachers were asked to estimate the percentage of their students that would perform at these three levels. The results were similar across grade levels for both teachers and students; therefore the results in Table V.10 are not broken down by grade level. The percentages in the teacher column represent an average across teachers of the percentages of students that they estimated would perform at each level.

Table V.10 Percentages of Students' and Teachers' Estimates for MSPAP Performance Levels

MSPAP Student Performance	Teachers' Estimate	Students' Estimate
Excellent	14%	31%
Satisfactory	45%	64%
Below Satisfactory	45%	5%

On average, the majority of teachers estimated that their student performance would be at the satisfactory or below satisfactory levels. Whereas, a higher percentage of students thought that their performance on MSPAP mathematics tasks was at the excellent level. In fact, only a very small percentage of students (5%) felt that their performance was below satisfactory. Although the results were similar across grades, a slightly higher percentage of 5th grade students than 8th grade students felt they did excellent (38% and 24%, respectively).

Beliefs About Meeting MSPAP Standards

Approximately 56% of the principals somewhat or strongly agreed with the statement that the goal of meeting MSPAP standards by the year 2000 is a realistic goal for their school and only 20% strongly disagreed. Approximately 42% of the teachers somewhat or strongly agreed with this statement and only 21% strongly disagreed. Further, when asked how important it was for them to see improved student performance on MSPAP from year to year, all the principals indicated that it was somewhat or very important. The majority of the teachers (85%) also indicated that it was somewhat or very important for them to see MSPAP performance gains from year to year.

Beliefs About Factors that Affect MSPAP Results

Principals and teachers were asked to indicate the extent to which various factors may contribute to MSPAP score gains for schools in the state. As shown in Table V.11, both principals and teachers indicated that there are a variety of factors that contribute a moderate or great extent to MSPAP score gains. The factors in the table are ordered according to the magnitude of the percent of principals who reported that the factor contributes to a moderate or great extent to MSPAP score gains.

Table V.11 Percentage of Principals and Teachers Indicating the Factors that Affect MSPAP Score Gains in the State

Factors	Principals	Teachers
Increased student familiarity with the format of MSPAP	97%	88%
Use of MSPAP-like tasks in regular instruction	97%	86%
Student improvement in knowledge and skills emphasized by MSPAP	94%	80%
General improvement of instruction	91%	76%
Use of MSPAP public release tasks or other performance tasks as test preparation materials	86%	79%
Differences between student populations from year to year	84%	81%
Improved test-taking skills	82%	79%
Increased student motivation	64%	56%

The two factors that received the highest percentages from both principals and teachers are increased student familiarity with the format of MSPAP and the use of MSPAP-like tasks in regular instruction. Similarly, the factor that received the smallest percentage from both principals and teachers is increased student motivation, although the percentages are still relatively high.

The results were consistent across elementary and middle school principals for the factors contributing to MSPAP score gains, with the exception of general improvement of instruction. Although

a similar percentage of elementary and middle school principals either somewhat or strongly agreed that the general improvement of instruction contributes to score gains (93% and 85%, respectively), the level of agreement differs. About 52% of the elementary principals strongly agreed compared to only 21% of middle school principals. Teachers across grades responded similarly to the questions regarding factors that contribute to score gains.

Impact of MSPAP

The results pertaining to the impact of MSPAP are provided in several sections: Overall impact of MSPAP, impact of MSPAP on instruction and classroom assessment, and impact of MSPAP on professional development activities.

Overall Impact of MSPAP

This section describes the overall impact of MSPAP on the principals, teachers and students as well as the impact of MSPAP on teacher and student morale. Principals and teachers were also asked to describe the positive and negative impacts.

Overall Impact on Principals, Teachers, and Students. Principals were asked to indicate the extent of both positive and negative impact of MSPAP on themselves, their teachers, and their students. Teachers were asked to indicate the extent of both positive and negative impact on themselves and their students. Further, students were asked to indicate the extent of both positive and negative impact of MSPAP on their schools.

Impact on Principals. The majority of the principals indicated that MSPAP had a moderate or very positive impact on them and that MSPAP had no or only a small amount of negative impact on them as summarized in Table V.12. When asked to respond to the statement that the positive impacts of MSPAP outweigh the negative impacts, 85% of the principals either somewhat or strongly agreed. The results were similar across elementary and middle school principals.

Table V.12 Percentage of Teachers and Principals Indicating the Extent of MSPAP's Positive and Negative Impact

	Moderate or Very *Positive* Impact	Small Amount or No *Negative* Impact
Impact on Principal - Principal's Perception	82%	75%
Impact on Teacher		
Teacher's Perception	52%	61%
Principal's Perception	80%	67%
Impact on Student		
Teacher's Perception	37%	66%
Principal's Perception	74%	86%

Principals were also asked to indicate the extent to which MSPAP had an impact on the time that they devote to instructional issues. Overall, 84% of the principals indicated that the time they devote to instructional issues has increased somewhat or greatly as a result of MSPAP. Elementary and middle school principals responded similarly to this question.

Impact on Teachers. Approximately half of the teachers indicated that MSPAP had a moderate or very positive impact on them and a greater percentage of teachers indicated that MSPAP had no or only a small amount of negative impact on them. Teachers responded similarly across grade levels. Principals were also asked to indicate the extent to which MSPAP had a positive and negative influence on the teachers in their schools. Interestingly, 80% of the principals indicated that MSPAP had a moderate or very positive impact on teachers. These results indicate that principals, as compared to teachers, perceive that MSPAP has had a greater positive impact on teachers. Approximately, 67% of the principals indicated that MSPAP had no or only a small amount of negative impact on teachers. This result is similar to what the teachers indicated.

When teachers were asked to respond to the statement that the positive impacts of MSPAP outweigh the negative impacts, 61% either somewhat or strongly agreed. This percentage is somewhat lower than the 85% of the principals who somewhat or strongly agreed with the statement.

Impact on Students. Less than half of the teachers reported that MSPAP had a moderate or very positive impact on students. However, 66% of the teachers indicated that MSPAP had no or only a small amount of negative impact on students. In contrast to the teacher results, 74% of the principals reported that MSPAP had a moderate or very positive impact on students and 86% reported that MSPAP had no or only a small amount of negative impact on students.

Students were asked how much of a positive and negative impact MSPAP has had on their school. Overall, the results across grades were somewhat similar. About 28% to 40% of students in grades 4, 5, 7, and 8 indicated that they did not know if MSPAP had a positive or a negative effect. The 4th grade students chose "don't know" more often than the other grades and 8th grade students chose "don't know" less often than the other grades (40% and 28%, respectively). A slightly higher percentage of 5th grade students (53%) compared to the other grade levels (about 42%) indicated that MSPAP has had a positive effect on their school. Whereas, more 8th grade students (31%), as compared to the other grade levels (about 20%), indicated that MSPAP has had a negative effect on their school.

Comments from Principals and Teachers on the Impacts of MSPAP. In addition to indicating the extent of positive and negative impacts of MSPAP, the principals and teachers were also to explain these impacts and indicate their overall reaction to MSPAP. Of the 515 mathematics teachers who completed the questionnaire, 383 (74%) of the teachers provided comments explaining the impacts of MSPAP.

Half of these teachers (50%) indicated that MSPAP had at least one positive impact and at least one negative impact, 39% of the teachers indicated only negative impacts, and 8% of the teachers indicated only positive impacts. The remaining 3% of teachers provided comments that were too vague to interpret or the teachers indicated that they were new and did not know about MSPAP. Of the 86 principals who completed the questionnaire, 67 (78%) also provided comments about the impacts of MSPAP. A larger percentage of principals compared to teachers indicated at least one positive and at least one negative impact of MSPAP (72%). Only 13% of the principals indicated only negative impacts and 12% indicated only positive impacts. The remaining 3% of principals provided comments that were too vague to be interpreted.

On average, a teacher's response contained approximately 4 different types of positive and/or negative comments, while a principal's response contained approximately 5 different comments. Thus, there were 1,536 comments coded for the teachers and 326 comments coded for principals. Table V.13 below includes a list of several areas in which the positive and negative comments were classified. The percentages in the table reflect the percent of comments coded in each category. For example, 40% of all the positive comments provided by teachers (182 out of 454 comments) were related to the positive impacts MSPAP has had on curriculum, instruction, and student learning in the classroom. Similarly, 41% of all the positive comments provided by principals (63 out of 152 comments) were related to positive impacts on curriculum, instruction, and student learning.

Table V.13 Positive and Negative Comments About MSPAP from Teachers and Principals

Positive Comments	Percentage of Teachers' Comments	Percentage of Principals' Comments
Impact on Curriculum/Instruction/Student Learning	40%	41%
Aspects of MSPAP	37%	29%
Impact on Accountability	6%	9%
Professional Development Support	3%	1%
Impact on Attitudes and Morale		
Teachers	5%	6%
Students	4%	4%
Principal	0%	0%
School	4%	7%
Parents	2%	2%
Negative Comments	**Percentage of Teachers' Comments**	**Percentage of Principals' Comments**
Impact on Curriculum/Instruction/Student Learning	11%	5%
Aspects of MSPAP	30%	29%
Impact on Accountability	23%	36%
Professional Development Support	7%	5%
Impact on Attitudes and Morale		
Teachers	13%	12%
Students	12%	5%
Principal	1%	4%
School	2%	1%
Parents	1%	2%

When comparing the percentages of positive and negative comments in each category, some interesting differences are found. With regard to the positive comments, the curriculum category contained the largest percent for teachers and principals. About half of the comments coded in this category indicated that there was an overall improvement of curriculum, instruction, assessment, or student learning because of MSPAP. The other half of the comments were related to more specific aspects of the curriculum, instruction, and assessment that improved such as more emphasis on higher-level thinking skills (e.g., problem solving and reasoning); teaching for conceptual understanding and making connections rather than procedural or rote memorization; more emphasis on mathematical communication; increase in real-world applications, use of MSPAP-like tasks/activities in instruction and assessment; and integration across subject areas. In contrast, for the negative comments, there was a smaller percentage of comments related to curriculum (11% for teachers' comments and 5% for

principals' comments). The most frequent types of negative impact on curriculum mentioned by teachers and principals were decreasing emphasis on basic skills (e.g., "students not learning the foundational skills"), too much emphasis is placed on test preparation (e.g., "teaching to the test"), not enough time during the school year to use lengthy performance tasks, school/county curriculum does not coincide with the Maryland Learning Outcomes, and restricts creativity (e.g., "has taken the fun out of teaching and learning").

Another difference between the positive and negative comments is with respect to MSPAP's impact on accountability. Only 6% of the teachers' positive comments and 9% of the principals' positive comments were related to positive impacts on accountability such as raising expectations and standards for students, providing teachers with standards and goals to teach toward, and providing useful feedback for making improvements and maintaining successful activities. A larger percentage of negative comments were related to accountability (23% for teachers and 36% for principals). These comments included the pressure to improve scores, competition within schools and across schools because of publication of results, overly concerned about school's test results and reputation and lack of concern about actual student learning, unrealistic expectations and goals, group scores rather than individual scores are focused upon, not appropriate to compare results for different student populations across years and across schools, and monetary rewards and reconstitution create tension.

Approximately similar percentages of the positive and negative comments were related to specific aspects of MSPAP itself, for example 37% of the teachers' positive comments and 30% of their negative comments were coded in this category. The most frequent positive comment about MSPAP was a belief in the overall goals and philosophy of MSPAP and that, overall, it is a positive way to assess students. Other specific comments were that the items are challenging, interesting, and engage students in higher-level thinking skills; items provide applications to the real-world, and the test is a good measure of students' abilities in the content area. The most frequent negative comments about MSPAP include the developmental inappropriateness for average students and below-average students, the week of administration is too long for students and requires too much preparation and time away from instruction, the items involve too much reading and/or writing, and the test does not accurately measure what students know in a content area.

Only a small percentage of both the positive and negative comments were related to professional development activities. Positive comments in this category included the availability of good materials and resources from the county or school, more workshops and inservices, encouraged better use of planning time, meetings became more focused on instruction and teaching strategies, and encouraged all teachers (on-grade and off-grade) to collaborate with each other. Negative comments related to

professional development were the lack of appropriate materials, resources, support, and assistance; the lack of time to plan lessons, the lack of direct classroom-based support to apply what was learned in inservices.

Finally, there were slightly larger percentages of negative comments compared to positive comments related to the attitudes and morale of teachers, students, principals, school, and parents. Examples of positive comments include "helped me to become a better teacher", "as teachers become familiar with MSPAP, morale improves", "students like the challenges in instruction", "students are more aware of the purpose of learning and value it", "students are proud of the schools' ranking", "school has a unified focus and everyone works together toward a common goal", and "parents are proud of the schools' ranking". The majority of negative comments were feelings of frustration and stress and that it is overwhelming to teachers and students. Other negative comments were " more work for teachers", "some teachers are resistant to change", "students are not motivated because no individual scores are provided", "school is obsessed with MSPAP/too much emphasis", and "parents are concerned about MSPAP".

Impact on Teacher and Student Morale. The majority of principals indicated that MSPAP had a somewhat or very *positive* impact on teacher morale (53%) and student morale (64%) in their schools, with less than half of the principals indicating that MSPAP had a somewhat *negative* impact on teacher morale (41%) and student morale (32%). However, the majority of teachers reported that MSPAP had a somewhat *negative* impact on teacher morale (62%) and on student morale (63%). Despite such reports of negative impacts, 61% of the teachers either somewhat or strongly agreed with the statement that the *positive* impacts of MSPAP outweigh the negative impacts.

The elementary and middle school principals reported similar levels of impact on teacher and student morale, and teachers across grade levels reported similar levels of impact on teacher and student morale.

Impact of MSPAP on Instruction and Classroom Assessment

This section describes the a) overall impact of MSPAP, the MLO's and the Maryland Curriculum Framework; b) overall impact of MSPAP on instruction and assessment; c) overall impact of MSPAP on procedural skills, problem solving, and explanations; d) impact of MSPAP on learning outcomes; e) impact of MSPAP on the use of MSPAP-like tasks; f) impact of MSPAP on teacher- and student-centered classroom activities; g) impact of MSPAP on instruction task types; h) impact of MSPAP on assessment task types; i) impact of various features of MSPAP; and j) preparing students for MSPAP.

For some of the questions regarding classroom activities and task types, teachers and principals were first asked to indicate the occurrence of certain activities in the 1996-97 instruction year, and they were then asked to indicate the extent to which the frequency of these activities changed from 1992-93 (the initial years of MSPAP). Only teachers who taught in a Maryland school during the 1992-93 year responded to the questions pertaining to the change in emphasis. Consequently, approximately 70% of the teachers responded to these questions. Students were only asked to indicate the extent to which the classroom activities occurred during the 1996-97 instruction year.

Overall Impact of MSPAP, MLO's, and Maryland Curriculum Framework. Teachers were asked to indicate the extent to which MSPAP, the Maryland Learning Outcomes (MLO's), and the Maryland Curriculum Framework (MCF) had an impact on their classroom activities and to indicate the extent to which the impact changed since 1992-93. The table below summarizes the findings. The values in the Table V.14 indicate the percentage of teachers who responded in either the "moderate" or "great" impact categories.

Table V.14 Percentage of Teachers Indicating that Various Sources had a Moderate or Great Amount of Impact

Source of Impact	Moderate or Great Impact 1996-97	Moderate or Great Increase in Impact 1992-97
MSPAP	82%	83%
MLO's	72%	56%
MCF	64%	44%

Overall, the majority of the teachers indicated that MSPAP had a moderate or great influence on their classroom activities, and the majority indicated that the influence increased a moderate or great extent since 1992-93. The majority of the teachers also indicated that the MLO's and Maryland Curriculum Framework had a moderate or great impact, but to a lesser extent than MSPAP's impact.

There were several differences across grade levels as summarized in Table V.15 below. In particular, there was a larger percentage of 3rd and 5th grade teachers as compared to the other grade-level teachers who indicated that both MSPAP and the MLO's had a "great" impact and that the impact increased a "great" extent since the inception of MSPAP (1992-93). Whereas, the 7th grade teachers had the smallest percentages in the "great" impact category.

Table V.15 Percentage of Teachers Indicating that Various Sources had a Great Amount of Impact

Source of Impact	3rd and 5th		2nd and 4th		8th		7th	
	Great Impact 1996-97	Great Increase 1992-97	Great Impact 1996-97	Great Increase 1992-97	Great Impact 1996-97	Great Increase 1992-97	Great Impact 1996-97	Great Increase 1992-97
MSPAP	58%	51%	32%	35%	40%	34%	21%	25%
MLO's	42%	34%	34%	26%	30%	16%	11%	12%

Overall Impact of MSPAP on Instruction and Assessment. Teachers and principals were asked to indicate the extent to which MSPAP influenced them (their teachers) to make *positive* changes in their (a) instruction and (b) assessment. Overall, the majority of the teachers indicated that MSPAP had either a moderate or great amount of positive impact on their instruction (76%) and assessment (68%). These percentages are larger for the results shown earlier regarding the overall positive impact of MSPAP, in that, only 52% of the teachers indicated that MSPAP had an overall positive impact on them and only 37% of the teachers indicated that MSPAP had an overall positive impact on their students. However, the results reported in this section indicate that when asked specifically about the impact of MSPAP on instruction and assessment, a relatively large percentage of teachers indicated that MSPAP had a moderate or great amount of positive impact. Table V.16 provides the percentages of teachers and principals by grade level who indicated that MSPAP had either a moderate or great amount of positive impact on instruction and assessment for the elementary and middle school on- and off-grade levels.

Table V.16 Percentage of Teachers and Principals Indicating that MSPAP had a Moderate or Great Amount of Positive Impact on Instruction and Assessment

Grade Level	Teachers Moderate/Great Amount of Positive Impact		Principals Moderate/Great Amount of Positive Impact	
	Instruction	Assessment	Instruction	Assessment
3rd and 5th	83%	75%	96%	93%
2nd and 4th	76%	70%	89%	85%
8th	74%	59%	96%	85%
7th	64%	57%	86%	78%

As shown in the table, 3rd and 5th grade teachers more often than the other teachers indicated that MSPAP had a moderate or great amount of positive impact on instruction and assessment. In contrast to the teachers' results, the middle school principals reported a similar level of impact for 8th grade as the elementary principals reported for the 3rd and 5th grades. However, for the question about MSPAP's positive impact on instruction, elementary school principals chose the category "a great amount" for 3rd and 5th grade teachers 73% of the time, whereas middle school principals chose this category for 8th grade teachers only 37% of the time.

Further, when asked to respond to the statement that the state has defined curriculum content well enough to make instruction and assessment changes so as to reflect the goals of MSPAP, the majority of the principals (62%) and the teachers (52%) somewhat or strongly agreed.

Overall Impact of MSPAP on Procedural Skills, Problem Solving, and Explanations. Teachers and students were asked to indicate the extent to which mathematical procedures and factual knowledge, problem solving and reasoning, and mathematical explanations and justifications were emphasized in their classroom during 1996-97. Further, teachers and principals were asked to indicate the extent to which the emphasis on these areas changed since the beginning of MSPAP (1992-93).

As indicated in Table V.17, the majority of teachers reported that they emphasized mathematical procedures and factual knowledge, problem solving and reasoning, and mathematical justifications and explanations either daily or at least once a week. The students' reported that their classrooms' emphasized the three areas somewhat less than what the teachers reported. For example, teachers, as compared to students, indicated that problem solving and reasoning was emphasized to a greater extent.

Table V.17 Percentage of Teachers and Students Indicating Classroom Coverage of Procedures, Problem Solving & Explanations

	Teachers		Students
	Daily/Weekly 1996-1997	Moderate/Great Increase 1992-1997	Daily/Weekly 1996-1997
Procedures/Factual Knowledge	88%	42%	73%
Problem Solving/ Reasoning	82%	75%	54%
Explanation/ Justification	68%	81%	49%

Approximately 42% of the teachers indicated that the emphasis on mathematical procedures and factual knowledge increased a "moderate" or "great" extent since 1992-93, with 43% of the teachers indicating that the emphasis was the same. However, the majority of the teachers indicated that the emphasis on problem solving and reasoning and mathematical explanations and justifications increased a "moderate" or "great" extent. It appears that teachers have placed a much greater emphasis on students' problem solving, reasoning, and use of explanations since the inception of MSPAP.

There were several differences across the grade levels for the teachers. A larger percentage of elementary on-grade (3rd and 5th) teachers reported that on a daily or weekly basis they emphasized problem solving and reasoning (89%) and the use of explanations (82%) as compared to off-grade (2nd and 4th) elementary teachers (83% and 68%, respectively), on-grade (8th) middle school teachers (74% and 50%, respectively), and off-grade (7th) middle school teachers (67% and 50%, respectively). The differences across grades is primarily in terms of the use of explanations. The change in emphasis was similar across grades.

Student responses to the questions regarding the emphasis of mathematical procedures and problem solving and reasoning were similar across grade levels. However, similar to the teacher results, there were differences between the elementary and middle grades with respect to the emphasis on mathematical justifications and explanations. About 30% of 4th and 5th grade students said they work daily on problems asking them to explain in writing how they got their answer, while only 14% of the 7th and 8th grade students indicated that this activity occurred daily. A larger percentage of the middle grade students (24%) said they never or only 3 to 4 times a year were asked to explain their answers compared to 10% of the elementary students.

Principals were asked to indicate how the emphasis of instruction, with respect to mathematical procedures and factual knowledge as well as mathematical problem solving and reasoning, changed from

1992-93 in the teachers' classrooms. The majority of the elementary principals indicated that the on-grade (3rd and 5th) and off-grade (2nd and 4th) teachers' emphasis on mathematical procedures and factual knowledge increased somewhat or greatly since 1992-93, 68% and 66%, respectively. Further, a larger percentage of elementary principals indicated that the on-grade (3rd and 5th) and off-grade (2nd and 4th) teachers' emphasis on mathematical problem solving and reasoning increased somewhat or greatly, 86% and 81%, respectively. The results from the middle school principals followed a pattern similar to the elementary school principals' results. The majority of the middle school principals indicated that the on-grade (8th) and off-grade (7th) teachers' emphasis on mathematical procedures and factual knowledge increased somewhat or greatly since 1992-93, 63% and 50%, respectively. Further, a larger percentage of elementary principals indicated that the on-grade (8th) and off-grade (7th) teachers' emphasis on mathematical problem solving and reasoning increased somewhat or greatly, 80% and 75%, respectively.

Thus, the principals' results support the teachers' results indicating that problem solving and reasoning has become a much greater focus in the classrooms since the beginning of MSPAP.

Impact of MSPAP on Learning Outcomes. Teachers and students were also asked a set of questions pertaining to the focus of their classroom activities with respect to MSPAP's process outcomes and content outcomes.

MSPAP's Process Outcomes. Most of the teachers indicated that they emphasize the process learning outcomes to a moderate or great extent and the increase in emphasis since the beginning of MSPAP has increased moderately or greatly as summarized in Table V.18.

Table V.18 Percentage of Teachers Indicating Emphasis and Increase in Emphasis of MSPAP's Process Outcomes

Process Outcomes	Moderate or Great Emphasis 1996-97	Moderate or Great Increase in Emphasis 1992-97
Problem Solving	96%	72%
Communication	87%	74%
Reasoning	93%	69%
Connections	87%	65%

The teachers across grades indicated a similar emphasis on problem solving, communication, reasoning, and connections; however, there were differences for the change in emphasis on problem

solving and reasoning. Although the majority of the teachers across grades (63% to 77% depending on grade) indicated that the emphasis on problem solving increased somewhat or greatly, the extent of increase differed. Overall, a larger percentage of elementary on-grade (3rd and 5th) teachers indicated that the increase in problem solving was great (33%) as compared to the other grade levels (10% to 15% depending on grade). The greatest difference across grades in the reported change in emphasis on reasoning was between the elementary on-grade (3rd and 5th) teachers and the middle school on-grade (8th) teachers. Approximately 77% of the elementary on-grade teachers indicated that change in emphasis on reasoning increased somewhat or greatly as compared to 56% of the middle-school on-grade teachers.

MSPAP's Content Outcomes. The majority of the teachers also indicated that they emphasize the content learning outcomes a moderate amount or a great deal as summarized in Table V.19 below. Teachers tended to indicate that the emphasis on these content outcomes in instruction either stayed the same or increased somewhat or greatly since 1992-93. Overall, it appears that none of the learning outcome emphases decreased over time.

Table V.19 Percentage of Teachers Indicating Emphasis and Increase in Emphasis of MSPAP's Content Outcomes

Content Outcomes	1996-1997	1992-1997	
	Moderate or Great Emphasis	Moderate or Great Increase in Emphasis	Same Amount of Emphasis
Numbers and Operations	94%	50%	48%
Geometry/Measurement	84%	51%	46%
Statistics	58%	54%	42%
Probability	53%	54%	42%
Patterns/Algebra	74%	60%	39%

There were several differences across grade levels in terms of the extent to which the teachers emphasized the content outcomes in the 1996-97 instructional year. Elementary grade teachers reported a greater emphasis on geometry/measurement as compared to middle school teachers, with 89% of the 2nd and 4th grade teachers and 92% of the 3rd and 5th grade teachers, as compared to 78% of the 7th grade teachers and only 63% of the 8th grade teachers, indicating that they emphasize geometry/measurement to a moderate or great extent. The 2nd and 4th grade teachers indicated less emphasis on statistics than the other grade level teachers. Only 46% of the 2nd and 4th grade teachers, as compared to 65% of the 3rd and 5th grade teachers, 70% of the 7th grade teachers and 55% of the 8th grade teachers, indicated that they emphasize statistics to a moderate or great extent. The 3rd and 5th

grade teachers reported a greater emphasis on probability as compared to the other grade-level teachers, in that, 65% of the 3rd and 5th grade teachers indicated that they emphasize probability to a moderate or great extent, while only 48% of the 2nd and 4th grade teachers, 48% of the 7th grade teachers, and 43% of the 8th grade teachers so indicated. Lastly, although there were similar percentages of teachers across grade levels indicating that they emphasized patterns/algebra to a moderate or great extent (68% to 79%), a larger percentage of 8th grade teachers (47%) indicated that they emphasized patterns/algebra to a great extent as compared to the other grade teachers (24% to 35%). The heavy emphasis on patterns/algebra in the 8th grade may help explain why their emphasis on other content areas was less as compared to the other grade levels.

Impact of MSPAP on Use of MSPAP-like Tasks in the Classroom. Teachers were asked to indicate how often they provide students with the opportunity to solve tasks similar to those on MSPAP. Similarly, students were asked to indicate the extent to which they have the opportunity to solve MSPAP-like tasks. Overall, 31% of the teachers indicated that students have the opportunity weekly or daily, 47% indicated every two weeks or monthly, 21% indicated about 4 times per year, and 2% said never. Overall, 38% of the students indicated that they solve such tasks weekly or daily, 33% indicated every two weeks or monthly, 22% indicated about 4 times per year, and 7% said never. In general, the results for teachers and students are similar, except that middle school students tended to indicate a greater use of MSPAP-like tasks than did their teachers.

As indicated in Table V.20, on-grade elementary teachers (3rd and 5th) indicated that they use tasks similar to those on MSPAP most frequently and 7th grade teachers indicated that they use them the least frequently. For example, 43% of the 3rd and 5th grade teachers indicated that they use them on a daily basis, whereas 14% of the 7th grade teachers indicated that they use them on a daily or weekly basis. Similarly, 43% of the 7th grade teachers indicated that they use them only about 4 times per year, whereas only 10% of the 3rd and 5th grade teachers indicated that they use them about 4 times per year.

Overall, the student results across grades are similar. However, there was a slight difference between off- and on-grades in that a smaller percentage of 4th and 7th grade students (35% and 31%, respectively) reported that they worked on MSPAP-like tasks daily or weekly when compared to the 5th grade (44%) and 8th grade students (40%).

Table V.20 Percentage of Teachers and Students Indicating Use of MSPAP-like Tasks in the Classroom

Teachers	Daily or Weekly	Every 2 Weeks/ Monthly	3 or 4 times per year	Never
All teachers	31%	47%	21%	2%
3rd and 5th	43%	47%	10%	0%
2nd and 4th	27%	50%	24%	0%
8th	26%	47%	24%	3%
7th	14%	38%	43%	5%
Students	Daily or Weekly	Every 2 Weeks/ Monthly	3 or 4 times per year	Never
All students	38%	33%	22%	7%
5th	44%	34%	17%	5%
4th	35%	34%	24%	7%
8th	40%	32%	20%	8%
7th	31%	32%	31%	6%

Teachers were also asked about their use of MSPAP public release tasks and Performance-Based School Improvement Exemplars for classroom purposes. Approximately 41% of the teachers indicated that they used the MSPAP public release tasks about 4 times a year and 18% indicated that they use them monthly, whereas 33% indicated that they never use MSPAP public release tasks for classroom purposes. Further, 35% of the teachers indicated that they used the Performance-Based School Improvement Exemplars about 4 times per year and 16% indicated that they use them monthly. Whereas, 39% indicated that they never use Performance-Based School Improvement Exemplars for classroom purposes.

On-grade elementary teachers (3rd and 5th) were most likely to use MSPAP public release tasks and Performance-Based School Improvement Exemplars for classroom purposes and 7th grade teachers were least likely to use them. For instance, 75% of the 5th grade teachers indicated they use MSPAP public release tasks monthly or about 4 times per year and only between 43% and 53% of the other grade level teachers indicated that they use them monthly or about 4 times per year. Further, only 13% of the 5th grade teachers indicated they never use MSPAP public release tasks, whereas between 41% and 53% of the other grade teachers indicated that they never use MSPAP public release tasks.

Impact of MSPAP on Teacher- and Student-Centered Classroom Activities. Teachers and students were asked to indicate the extent to which classroom activities and discussions were teacher- or student-centered. Overall, 77% of the teachers indicated that they presented to the class daily, 60%

indicated whole class discussions occurred daily, and 63% indicated that individual student seat work occurred daily. A smaller percentage of teachers (42%) indicated that student group work occurred daily; however, an additional 44% of the teachers indicated that group work occurred at least once a week. The majority of the teachers indicated that the emphasis on teacher presentations (70%), whole class discussions (61%), and individual seat work (60%) remained the same since 1992-93. Whereas, 42% of the teachers indicated that group work increased somewhat since 1992-93 and 37% indicated that the emphasis on group work remained the same.

There were two general differences across grade levels in the type of classroom activities reported. Elementary school teachers reported more frequent use of whole class discussions than middle school teachers. Secondly, elementary school teachers reported more frequent use of small group work, with nearly 50% of the elementary teachers indicating that small group work occurs daily and only 30% of middle school teachers indicating that small group work occurs daily.

Overall, 81% of the students indicated that teachers presented to the class daily, 42% of the students indicated that whole class discussions occurred daily, and 60% indicated the they did individual seat work daily. These results are similar to the results reported by the teachers. However, the percentage of students that indicated that they worked in groups either daily or weekly was lower than what the teachers' reported, 10% and 22%, respectively.

With respect to teachers presenting to the class, whole class discussions, and individual seat work, the percentages across grade levels for students were very similar. For small group work, however, larger percentages of off-grade students (4^{th} and 7^{th}) said they never or only 3 to 4 times a year worked in small groups (34%) while only 18% of the 5^{th} grade students and 25% of the 8^{th} grade students selected these categories.

Impact of MSPAP on Instruction Task Types

Instruction Task Types. Teachers and students were asked to indicate the use of various task types in their mathematics classrooms. Teachers were also asked to indicate how the emphasis on task types changed since the beginning of MSPAP (1992-93).

Although teachers reported using textbook problems more frequently than open-ended problems, the majority of the teachers indicated that since 1992-93 the use of open-ended problems increased somewhat or to a great extent as indicated in Table V.21 below. Whereas, most of the teachers indicated that the use of textbook problems stayed the same or decreased. Teachers reported less frequent use of extended problems that take a few days to complete, which is not unreasonable given the amount of time that is required to solve such tasks, but overall, 57% of the teachers indicated that the use of extended

problems increased moderately or greatly since 1992-93. The majority of teachers indicated that they use tasks that apply mathematics to real-life situations daily or weekly, and the use of such tasks has increased since 1992-93. The majority of teachers also indicated that they use tasks that require manipulatives daily or weekly, and the use of manipulatives has increased. Further, half of the teachers indicated that they use tasks that integrate other subject areas in math on a daily or weekly basis, and the use of integrated tasks has increased.

In contrast to the teachers' results, the percentage of students who indicated that they worked on open-ended problems (i.e., problems that ask you to show your work and explain your answer) and textbook problems daily or weekly was similar, 77% and 73%, respectively. The students' reported use of open-ended problems (73%) was greater than the teachers' reported use (59%). As did the teachers, however, students indicated that they less frequently worked on extended problems that take a few days to complete, with only 18% of the students indicating that they work on extended problems daily or weekly. However, a larger percentage of students (31%) than teachers (17%) indicated that extended problems are never used in instruction. Further, a smaller percentage of students than teachers indicated that they solve tasks that apply mathematics to real life situations, use manipulatives, and integrate other subject areas in math daily or weekly.

Table V.21 Percentage of Teachers and Students Indicating Emphasis and Impact of MSPAP On the Use of Instruction Task Types

Task Types	Emphasis 1996-97				Change in Emphasis 1992-97	
Teachers	Daily/ Weekly	Biweekly/ Monthly	4 times per year	Never	Increase	Same
Textbook	74%	18%	4%	4%	11%	59%
Open-ended	59%	32%	6%	3%	65%	33%
Extended	18%	41%	24%	17%	57%	39%
Real-life	78%	20%	1%	0%	66%	32%
Manipulatives	59%	34%	7%	1%	52%	44%
Integrated	50%	40%	9%	1%	64%	34%
Students						
Textbook	73%	17%	6%	4%	--	--
Open-ended	77%	17%	4%	1%	--	--
Extended	18%	31%	21%	31%	--	--
Real-life	46%	28%	14%	13%	--	--
Manipulatives	30%	39%	21%	11%	--	--
Integrated	26%	39%	22%	13%	--	--

Differences Across Grade Levels on Instruction Task Types. There were several differences between elementary and middle school teachers as well as between on- and off-grade teachers. In general, elementary teachers as compared to middle-school teachers indicated a more frequent use of open-ended problems, with 3rd and 5th grade teachers reporting the greatest increase in use. Whereas, middle-school teachers as compared to elementary school teachers indicated a more frequent use of textbook problems, with the elementary school teachers indicating a greater decrease in use. Further, elementary teachers tend to use integrated math tasks more frequently than middle school teachers.

With regard to on- and off-grade teachers, approximately 50% of the off-grade (2nd, 4th, 7th) teachers indicated that they never use extended tasks or only use them about 4 times per year, whereas only 30% 3rd and 5th grade teachers and 40% of the 8th grade teachers indicated that they never use extended tasks or only use them about 4 times a year. Further, 3rd and 5th grade teachers tended to show a greater increase in use of extended tasks since the inception of MSPAP.

There were also differences for the student results across grades. As the grade-level increased, the percentage of students who indicated that they have textbook problems weekly or daily increased. About 61% of 4th grade students reported frequent use compared to 84% of 8th grade students. A smaller percentage of students in 4th grade (69%) versus students in 5th grade (83%) indicated that they worked on open-ended problems either weekly or daily. The percentages for the other two grade levels were similar to the 5th grade reported percentage. No differences were found across grades for frequency of working on extended problems. With respect to manipulatives, the elementary grades (4th and 5th) indicated more frequent use than the middle grades, at least every 2 weeks. The difference was especially noticeable between the 5th grade (56%) and the 7th grade (34%). About 50% of the 5th grade students indicated that they work on problems integrating other subjects in math at least every 2 weeks. This percentage is slightly more than the other grades, especially in 7th grade where only 35% of the students reported this level of use. Lastly, there were no differences across the grade-levels with regard to students' reported use of math to solve real-life problems.

Classroom Instruction's Impact on MSPAP Performance. Students in both 5th and 8th grade were also asked to indicate the extent to which the problems and activities in their math classes helped them answer the math tasks on MSPAP, and 4th and 7th grade students were asked to indicate the extent to which their math classes would help them answer tasks like those on MSPAP. The 4th and 7th grade students were given a released MSPAP task to examine prior to completing the questionnaire. Overall, 80% of the students indicated that their classroom activities helped them (or would help them) answer the math tasks on MSPAP a moderate amount or very much. Whereas, the percentage of students who

indicated that their classroom activities did not help them (or would not help them) at all to solve MSPAP tasks was only 3%.

The differences between the percentage of students who indicated that the problems in their math classes helped them answer the MSPAP tasks a moderate amount or very much were not large. The largest difference being between the on-grade elementary (3rd and 5th) students and the on-grade middle school (8th) students, 88% and 72%, respectively. However, 53% of the 3rd and 5th grade students chose the category "very much" and only 32% of the 8th grade students chose this category.

Impact of MSPAP on Assessment Task Types. Teachers and students were asked to indicate the extent to which various task formats are used for classroom assessments. Teachers were asked to indicate the extent to which they use various assessment task types and how the emphasis has changed since the beginning of MSPAP, whereas students were only asked to indicate the extent to which the various task types are used in their classrooms.

Traditional Assessment Task Types. In general, teachers reported that they use short answer items more often than multiple-choice and end-of-unit textbook items as shown in Table V.22. Further, teachers indicated that their use of short answer items has increased more than their use of multiple-choice and textbook items. Overall, the students' results were similar to the teachers' results with one exception; students, as compared to teachers, reported a much greater use of textbook items. Further, as the grade-level increased, so did the frequency with which they were used. For example, 49% of 4th grade students versus 69% of 8th grade students reported working on them every week. These results are similar to those reported in an earlier section regarding use of textbook problems in instruction.

Table V.22 Percentage of Teachers and Students Indicating the Emphasis and Impact of MSPAP On the Use of Traditional Assessment Task Types

Task Type	Emphasis 1996-97				Change in Emphasis 1992-97*	
Teacher	Weekly	Biweekly / Monthly	4 times per year	Never	Increase	Same
Multiple Choice	9%	38%	30%	23%	13%	53%
End of unit text items	9%	54%	19%	17%	13%	68%
Short Answer	34%	54%	8%	4%	36%	54%
Students						
Multiple Choice	13%	47%	29%	12%	--	--
End of unit text items	60%	24%	10%	6%	--	--
Short Answer	32%	44%	17%	6%	--	--

* The increase category combines "moderate" and "great" increase.

Use of Alternative Assessment Task Types as Reported by Teachers. As shown in the Table V.23 below, the reported use of open-ended problems for assessments was more frequent than the use of multiple-choice items, with 25% of the teachers indicating that they use open-ended tasks weekly and 56% indicating that they use them biweekly or monthly. Further, 60% of the teachers indicated that their use of open-ended tasks increased to a moderate or great extent since the beginning of MSPAP. Compared to the use of open-ended tasks, the use of extended tasks that take a few days to complete occurs less often. However, this might be expected due to the time required for extended tasks. Approximately 8% of the teachers indicated that they use extended tasks weekly and 48% indicated that they use them bimonthly or monthly. More importantly, however, the majority of the teachers (52%) indicated that they have increased the use of such tasks on assessments to a moderate or great extent. Approximately 88% of the teachers indicated that manipulatives were used with assessments weekly, bimonthly or monthly, and 50% indicated that the use of manipulatives increased to a moderate or great extent.

The majority of the teachers (86%) indicated that they use assessments which require written explanations weekly, biweekly or monthly, and 73% of the teachers indicated that the requirement of written explanations increased somewhat or greatly. Of particular interest is that 40% of the teachers indicated that they ask students to write in their journals on a weekly basis. Another 27% of the teachers reported that they ask students to write in their journals bimonthly or monthly. Further, the majority of the teachers indicated that the use of journals increased somewhat or greatly since 1992-93. The reported increased use of journal writing and written explanations supports the previously reported increased focus on communication in the classrooms.

Table V.23 Percentage of Teachers and Students Indicating the Emphasis and Impact of MSPAP On the Use of Alternative Assessment Task Types

Task Type	Emphasis 1996-97				Change in Emphasis 1992-97	
Teacher	Weekly	Biweekly/ Monthly	4 times per year	Never	Increase	Same
Open-ended	25%	56%	15%	6%	60%	38%
Extended	8%	48%	32%	12%	52%	44%
Manipulatives	48%	40%	10%	3%	50%	47%
Explanations	40%	46%	11%	4%	73%	25%
Journals	40%	27%	12%	21%	54%	42%
Portfolios	11%	25%	14%	50%	39%	57%
Group activity	48%	41%	8%	3%	58%	41%
Scoring rubric	22%	45%	23%	11%	72%	25%
Students						
Open-ended	57%	33%	8%	2%	--	--
Extended	3%	36%	42%	19%	--	--
Manipulatives	13%	44%	32%	11%	--	--
Explanations	--	--	--	--	--	--
Journals	20%	17%	11%	52%	--	--
Portfolios	6%	15%	14%	64%	--	--
Group activity	8%	42%	34%	17%	--	--
Scoring Rubric	--	--	--	--	--	--

In general, teachers indicated that they used portfolios less often than the other assessment formats; however, teachers indicated an increase in their use since 1992-93. Most of the teachers indicated that group assessments occur weekly, biweekly or monthly, and 58% of the teachers indicated that the use of group assessments has increased to a moderate or great extent.

Overall, 67% of the teachers reported that they use scoring rubrics weekly, biweekly or monthly. Only 11% of the teachers indicated that they do not use scoring rubrics. Moreover, 72% of the teachers indicated that the use of rubrics increased to a moderate or great extent. A promising finding from these results is the increased use of open-ended tasks, extended tasks, journals, portfolios, group assessments, and scoring rubrics in mathematics classrooms.

Use of Alternative Assessment Task Types as Reported by Students. As indicated in Table V.23 above, students indicated a greater use of open-ended problems than did their teachers and they indicated about the same amount of use of extended tasks. However, students, as compared to their teachers, reported less frequent use of tasks that involve manipulatives, journals, portfolios, and group assessments.

Students were also asked whether their teachers explained to them how student work was graded. Approximately, 80% of the students indicated "yes". There was no difference across grade levels. This question also asked students to explain how their work was graded.

Teacher Differences Across Grade Levels for Alternative Task Types. Differences across grade levels for teachers occurred for the use of open-ended problems, manipulatives, written explanations, journals, portfolios, and scoring rubrics. In general, elementary school teachers, as compared to middle school teachers, indicated more frequent use of these types of assessments. Elementary school teachers as compared to middle school teachers indicated a more frequent use of open-ended problems, with 3rd and 5th grade teachers reporting the most frequent use (66% indicated weekly or biweekly (i.e., every 2 weeks)) and 7th grade teachers reporting the least frequent use (only 35% indicated weekly or biweekly). Further, 3rd and 5th grade teacher reported the greatest change in frequency of use and the 7th grade teachers reported the least amount of change in use.

Elementary school teachers, as compared to middle school teachers, indicated a more frequent use of manipulatives with classroom assessments, with 65% of the 2nd/4th grade teachers and 55% of the 3rd/5th grade teachers indicating that they have student use manipulatives with classroom assessments weekly and only 14% of the 7th grade teachers and 26% of the 8th grade teachers indicating such frequent use of manipulatives.

Approximately 77% of the 3rd/5th grade teachers and 66% of the 2nd/4th grade teachers require students to provide written explanations weekly or biweekly, whereas 54% of the 8th grade teachers and only 43% of the 7th grade teachers do so. Although the majority of the teachers in each of the grades indicated that the use of written explanations increased since the inception of MSPAP, the extent of the increase differed across grade levels. Forty-six percent of the 3rd/5th grade teachers and 37% of the 2nd/4th grade teachers indicated that they increased the use of written explanations a "great" extent, whereas 21% of the 8th grade teachers and 14% of the 7th grade teachers indicated that they increased the use to a "great" extent. Approximately 66% of the elementary school teachers and only 23% of the middle school teachers have students write in journals on a weekly or biweekly basis. Further, 64% of the 3rd/5th grade teachers and 57% of the 2nd/4th grade teachers indicated that their use of journals increased somewhat or greatly since the inception of MSPAP, whereas 39% of the 8th grade teachers and only 28% of the 7th grade teachers indicated that their use of journals increased.

Approximately 26% of the on- and off-grade elementary school teachers indicated that they use portfolios on a weekly or biweekly basis, whereas 16% of the 8th grade teachers and only 6% of the 7th grade teachers indicated weekly or biweekly use of portfolios. Further, the majority of the 8th grade (65%) and the 7th grade (70%) teachers indicated that they never use portfolios, whereas only 45% of the

3rd/5th grade and 38% of the 2nd/4th grade teachers indicated they never use them. Approximately 50% of the elementary school teachers indicated that their use of portfolios has increased, whereas less than 25% of the middle school teachers have reported an increase use of portfolios.

Teachers of 3rd and 5th grades reported the most frequent use of scoring rubrics and 7th grade teachers reported they use them the least amount, with 54% of the 3rd/5th grade teachers indicating that they use rubrics weekly or biweekly and only 19% of the 7th grade teachers indicating that they use rubrics weekly or biweekly. In addition, 82% of the 3rd/5th grade teachers indicated that their use of rubrics has increased somewhat or greatly and between 63% and 68% of the other grade levels indicated that their use of rubrics has increased.

Student Differences Across Grade Levels for Alternative Task Types. Differences across elementary and middle school grades occurred for the use of journals and portfolios. About 74% of middle school students compared to 33% of elementary students indicated that they never use journals. Similarly, 77% of middle school students and 54% of elementary students said they never use portfolios.

Overall, the elementary students reported more frequent use of group assessments than middle school students. The difference was largest when comparing the 5th grade to the 7th grade. About 61% of 5th grade students said that group assessments occurred at least once a month, while only 39% of 7th graders reported the use of group assessments this frequently. A similar result occurred with respect to the use of manipulatives on assessments, 65% of 5th graders and 41% of 7th graders said they use them once a month or more. Overall, these percentages are similar to those the students reported for instructional use.

Impact of Various Features of MSPAP. Teachers and principals were also asked to indicate the extent to which various aspects of MSPAP positively influenced their (the teachers') classroom activities. As shown in Table V.24, the aspects of MSPAP that were addressed include the format of MSPAP tasks, the content and skills assessed by MSPAP, MSPAP's integration across subject areas, MSPAP's scoring procedures, and MSPAP's results.

Table V.24 Percentage of Teachers and Principals Indicating the Extent of Impact on Classroom Activities for Various Aspects of MSPAP

MSPAP Aspect	Moderate or Great Amount of Positive Impact	
	Teachers	Principals
Format of MSPAP Tasks	61%	88%
Content and Skills Assessed by MSPAP	67%	93%
MSPAP's Integration Across Subjects	64%	80%
MSPAP's Scoring Procedures	51%	77%
Results of MSPAP	49%	86%

In general, the majority of both the teachers and principals reported a moderate or great amount of positive impact for each of the aspects of MSPAP. However, the percentages were larger for principals than teachers. These results are similar to the previously reported results for the overall question pertaining to the impact of MSPAP.

Elementary and middle school principals tended to respond similarly, whereas teachers tended to differ across the grade levels. Across the various features of MSPAP, a larger percentage of 3rd and 5th grade teachers, as opposed to teachers in other grade levels, chose the categories "moderate" and "great", whereas the 7th grade teachers were least likely to choose these categories. As an example, for the questions regarding the content and skills assessed by MSPAP and MSPAP's scoring procedures, 75% and 60% of the 3rd and 5th grade teachers chose the moderate and great categories, respectively, whereas, 51% and 28% of the 7th grade teachers chose them, respectively.

Preparing Students for MSPAP. Principals, teachers, and 5th and 8th grade students were asked to respond to questions in two major categories of test preparation methods: a) direct test preparation methods including improving student test taking skills, improving student motivation, providing practice with similar tasks just prior to the assessment, and b) instructional methods such as changing and/or improving instruction throughout the year. Off-grade teachers as well as on-grade teachers were asked questions about preparing students for MSPAP to determine the extent to which MSPAP has had an effect on both on- and off-grade teachers' areas of practices.

As summarized in the Table V.25 below, the majority of the teachers, students, and principals indicated, to a moderate or great extent, that there is a focus on improving student test taking skills, improving student motivation, and using MSPAP public release tasks or other performance-based tasks as test preparation materials. Overall, students and teachers responded similarly. However, principals reported that their teachers used these types of test preparation activities more often than what the teachers reported.

With respect to making changes in instruction to help students prepare for MSPAP, the majority of the teachers, students, and principals indicated, to a moderate or great extent, that there has been an increased use of MSPAP-like tasks in instruction. The majority of the teachers and principals also indicated that the match between the content of instruction and the content of MSPAP has increased. More importantly, most of the teachers and principals (89% and 93%, respectively) reported that there has been a general improvement in instruction throughout the year. Across the test preparation activities, teachers and principals were more in agreement with the statement that teachers improved instruction throughout the year than with any of the other test preparation activities.

Table V.25 Percentage of Teachers, Students, and Principals Indicating a Moderate or Great Use of Various MSPAP Preparation Activities

Direct Test Preparation Methods	Teacher	Student	Principal
Improve student test-taking skills	77%	70%	93%
Improve student motivation	69%	82%	93%
Use of MSPAP-like tasks (e.g., release tasks)	63%	68%	96%
Instructional Methods			
Increase use of MSPAP-like tasks	76%	71%	94%
Increase match between content of MSPAP and content of instruction	73%	--	83%
General improvement of instruction	89%	--	93%

The results for elementary and middle school principals were similar. However, there were several differences in the results for teachers across grade levels. The teacher results for the test preparation activities related to improving student test-taking skills and improving student motivation were somewhat similar across grades, except between the elementary on-grade (3rd and 5th) teachers and the middle school off-grade (7th) teachers. About 83% of 3rd and 5th grade teachers focused on improving test-taking skills to a moderate or great extent compared to 67% of the 7th grade teachers. Similarly, about 84% of 3rd and 5th grade teachers focused on improving student motivation to a moderate or great extent as compared to only 42% of the 7th grade teachers. In these two instances, the percentages for the other grade level teachers were between these two extremes.

In terms of using MSPAP public release tasks or similar tasks as test preparation materials, a large percentage of 3rd and 5th grade teachers (81%) reported a moderate or great amount of use. The percentages for all the other grade-levels were lower (49% for 2nd and 4th grade, 36% for 7th grade, and 63% for 8th grade).

A higher percentage of elementary school teachers (both on- and off-grade) than middle school teachers reported that, to a moderate or great extent, they were improving instruction throughout the year and increasing the match between the content of instruction and content of MSPAP. Approximately 94% of the elementary teachers and 79% of the middle school teachers reported they have improved instruction throughout the year, and 78% of the elementary teachers and 58% of the middle school teachers indicated that they have increased the content match between instruction and MSPAP. As previously indicated, the test preparation activity that was most common for teachers was the general improvement of instruction throughout the year.

Also, there were several differences between the 5th and 8th grade student responses to these questions. For instance, 75% of 5th grade students versus 65% of 8th grade students said that their math teacher gave them tips on how to take MSPAP (i.e., improved their test-taking skills). In addition, 91% of 5th graders indicated that their math teacher talked to them about doing their best on MSPAP (i.e., motivating students) compared to only 72% of 8th graders. Student responses to the questions regarding use of MSPAP-like math activities prior to the assessment and throughout the year were similar across grade levels.

Impact of MSPAP on Professional Development Activities

This section describes the content and extent of teacher professional development activities and the extent of principal professional development activities that are directly related to MSPAP and the MLO's.

Content of Teacher Professional Development Activities. Teachers were asked questions regarding the extent to which professional development activities for the 1996-97 school year, including the summer of 1996, addressed the MLO's, Maryland Curriculum Framework, and specific topics related to MSPAP. As shown in the Table V.26, approximately half of the teachers indicated that the MLO's and the Maryland Curriculum Framework were addressed to a moderate or great extent. Further, the majority of the teachers indicated that the purpose of MSPAP, format of MSPAP, content and skills assessed by MSPAP, preparing students for MSPAP, and using MSPAP results to improve instruction was emphasized a moderate or great extent in professional development meetings. The topic related to MSPAP that was emphasized the least was explaining results to parents and students.

Table V.26 Percentage of Teachers Indicating the Topics Covered in Professional Development Activities

Topics	Moderate/ Great	Not At All
Maryland Learning Outcomes	56%	20%
Maryland Curriculum Framework	45%	29%
Purpose of MSPAP	69%	7%
MSPAP Task Format	79%	6%
MSPAP Content and Skills	82%	4%
Preparing Students for MSPAP	78%	5%
Use of MSPAP Results to Improve Instruction	64%	11%
Explaining MSPAP Results to Parents and Students	31%	36%

Teachers responded differently across grade levels for the professional development questions addressing the MLO's, purpose of MSPAP, content and skills assessed by MSPAP, preparing students for MSPAP, interpreting and using MSPAP results to improve instruction, and explaining MSPAP results to students and parents. In general, elementary school teachers indicated that these topics were emphasized by professional development activities more often than did middle school teachers, with 7th grade teachers indicating the least frequent emphasis of these topics in staff development activities.

Extent of Teacher Professional Development Support

Teacher Professional Development Support. Teachers and principals were asked to indicate the extent to which they (their teachers) had the necessary support and/or resources to enable teachers to make instruction and assessment changes to better reflect what is expected of students in MSPAP and the MLO's. As summarized in Table V.27, the majority of the teachers indicated, either to a moderate or a great extent, that they had the necessary support and/or resources to enable them to make instructional and assessment changes to better reflect what is expected of students in MSPAP and the MLO's. Only a small percentage of teachers indicated that they did not have the necessary support and/or resources to make changes in instruction and assessment. Teachers of 3rd and 5th grade, as compared to the other grade level teachers, indicated that they were the most satisfied with the level of support. Overall, principals, as compared to teachers, indicated that teachers had a greater level of professional development support.

Table V.27 Percentages of Teachers and Principals Indicating the Extent of Teacher Professional Development Support

Instruction	Moderate/ Great Amount of Support		No Support	
	Teachers	Principals	Teachers	Principals
All grades	63%	--	6%	--
3rd and 5th	72%	92%	2%	0%
2nd and 4th	60%	90%	10%	0%
8th	58%	86%	9%	0%
7th	58%	79%	3%	0%
Assessment				
All grades	56%	--	10%	--
3rd and 5th	67%	86%	6%	0%
2nd and 4th	52%	81%	12%	2%
8th	49%	86%	13%	0%
7th	47%	75%	8%	4%

Frequency of MSPAP Teacher Professional Development Activities. Teachers were also asked to indicate the number of hours that they would spend in professional development meetings that are directly related to MSPAP (e.g., meetings focusing on the nature and purpose of MSPAP, MSPAP tasks, MSPAP scoring, and MSPAP results). As summarized in the Table V.28 below, 32% of the teachers indicated that they would spend over 16 hours in professional development meetings that are directly related to MSPAP within the 1996-97 instructional year, including the summer of 1996. Approximately equal percentages indicated that they would spend between 6-15 hours and between 1-5 hours. Only 7% indicated that they would spend no time in such professional development meetings. Elementary school teachers, in particular, on-grade teachers (3rd and 5th) indicated the most amount of time and 7th grade teachers indicated the least amount of time in MSPAP-related professional development activities.

Table V.28 Number of Hours of MSPAP Professional Development Activities

Grade	Hours				
	0	1-5	6-15	16-35	>36
All	7%	29%	32%	20%	12%
3rd and 5th	4%	21%	31%	27%	18%
2nd and 4th	6%	30%	35%	19%	10%
8th	12%	32%	31%	19%	7%
7th	12%	45%	30%	7%	7%

Extent of Various Types of Teacher Professional Development Support. Teachers and principals were asked to indicate the extent to which teachers had the necessary support and/or resources in a

number of areas to enable them (their teachers) to make changes in their classroom activities to better reflect what is expected of students in MSPAP and the MLO's. As Table V.29 indicates, teachers reported that they receive the most amount of support in terms of inservices or workshops, whereas they get the least amount of support with direct assistance in the classroom (e.g., demonstration lessons). Overall, principals, as compared to the teachers, reported that the teachers receive more support in each of the areas. In particular, principals perceived that teachers had more time to collaborate with other teachers.

Table V.29 Percentage of Teachers and Principals Indicating the Extent of Various Types of Teacher Professional Development Support

Type of Support	Moderate/ Great Amount of Support		No Support	
	Teachers	Principals	Teachers	Principals
Inservices/ Workshops	65%	87%	4%	1%
Test Preparation Materials	50%	85%	15%	1%
Instructional Materials	48%	77%	15%	2%
Collaboration with other Teachers	34%	72%	17%	1%
Planning Time	24%	44%	36%	15%
Classroom Assistance	16%	54%	59%	15%

Teachers across grade levels responded similarly except for the question regarding test preparation materials. As might be expected, on-grade teachers (3rd, 5th, and 8th) indicated more support with regard to having test preparation materials than off-grade teachers. In particular, 62% of the on-grade elementary teachers and 49% of the on-grade middle school teachers indicated that they had a moderate or great deal of support in terms of having test preparation materials, whereas 40% of the off-grade elementary teachers and 38% of the off-grade middle school teachers indicated this same level of support. Elementary and middle school principals responded similarly to these questions.

Extent of Principal Professional Development Support. Principals were asked to indicate the extent to which they had enough support and information to help them move their schools towards the goals of MSPAP. Overall, 85% of the principals indicated, to either a moderate or great extent, that they had the necessary support and information about MSPAP to help them move toward the goals of MSPAP. Elementary and middle school principals responded similarly to this question.

VI. Confirmatory Factor Analyses and Statistical Tests for the Questionnaire Data

Confirmatory Factory Analyses for the Mathematics Teacher Questionnaire

Confirmatory factor analyses (CFA; Joreskog, 1969; Joreskog & Sorbom, 1979) allowed for the examination of the underlying structure of the teacher questionnaire. The teacher questionnaire was designed to provide information about six dimensions. They included teachers' familiarity with MSPAP, teachers' support for MSPAP, teachers' instruction and assessment practices, change in teacher's instruction and assessment practices, MSPAP's impact on instruction, and professional development support for teachers. Subsets of items were grouped according to the following 11 areas (i.e., measures) to reflect the six dimensions:

(1) MSPAP Familiarity – General (teachers' general familiarity with MSPAP),

(2) MSPAP Familiarity – Results (teachers' familiarity with MSPAP results),

(3) Support MSPAP – General (teachers' general support for MSPAP),

(4) Support MSPAP – Instruction (teachers' support for MSPAP for instructional purposes),

(5) Current Math Instruction/Assessment - LO (emphasis on learning outcomes in instruction and assessment),

(6) Current Math Instruction/Assessment - PT (emphasis on reform-oriented problem types in instruction and assessment),

(7) Change Math Instruction/Assessment - LO (change in emphasis on learning outcomes in instruction and assessment),

(8) Change Math Instruction/Assessment - PT (change in emphasis on reform-oriented problem types in instruction and assessment),

(9) MSPAP's Impact (MSPAP's impact on instruction and assessment),

(10) Professional Development Support - MSPAP (professional development activities related to MSPAP), and

(11) Professional Development Support - Amount (amount of professional development activities).

Teacher mean scores were obtained for each of these eleven subsets of items. The majority of the items on the questionnaire had a four-point Likert scale. For those items that had more than a four point scale, the responses were recoded to a four-point scale. Teacher data were excluded for those cases in which teachers had left blank more than 25% of the items on any one of the eleven subsets of items. Based on

the intercorrelations among the items and the item-to-total score correlations, a small number of items were deleted from their respective subsets. For example, a few items were deleted due to low item-to-total score correlations. Figure VI.1 provides the final set of items for each of the subsets and the hypothesized dimension underlying each of the subset of items. Coefficient alpha reliability estimates for these 11 subsets (i.e., measures) for both on- and off-grade data sets ranged from .74 to .93.

Figure VI.1 Hypothesized Dimensions, Measures, and Mathematics Teacher Questionnaire Items

Dimension/ Measure	Teacher Questionnaire Item
MSPAP Familiarity	
General	To what extent are you familiar with each of the following?
	purpose of MSPAP
	format of MSPAP tasks
	content and skills assessed by MSPAP
	how to prepare students for MSPAP
Results	how to interpret and use MSPAP results to improve classroom instruction and assessment
	how to explain MSPAP results to students and/or parents
Support MSPAP	
General	To what extent do you support or oppose MSPAP?
	To what extent has your support or opposition of MSPAP changed over the last few years?
	To what extent do you support or oppose the reporting of MSPAP results?
	To what extent do you support or oppose holding schools accountable for meeting the performance standards on MSPAP?
Instruction	MSPAP is a useful tool for helping me make positive changes in my instruction.
	MSPAP is a useful tool for making positive changes in instruction for those teachers who are resistant to change.
	Results of MSPAP provide useful information for making inferences about school improvement.
Current Math Instruction/Assessment	
Learning Outcomes	About how often have you asked your students to work on classroom activities that emphasize mathematical problem solving and reasoning this year (1996-97)?
	About how often have you asked your students to work on classroom activities requiring mathematical explanations and justifications this year (1996-97)?
	About how much emphasis have you placed on each of the following learning outcomes (LO) in your mathematics instruction this year (1996-97)?
	problem solving
	communication
	reasoning
	connections

Figure VI.1 Hypothesized Dimensions, Measures, and Mathematics Teacher Questionnaire Items – Continued

	About how much emphasis have you placed on each of the following LO in your mathematics assessment this year (1996-97)?
	problem solving
	communication
	reasoning
	connections
Problem Type	About how often have you used each of the following types of problems in your mathematics classroom this year (1996-97)?
	open-ended problems
	problems that take a few days or more to complete
	problems emphasizing relationships among mathematics concepts
	problems that integrate other subject areas in math
	problems that apply math to real-life situations
	About how often have you used each of the following types of assessment questions and activities this year (1996-97)?
	open-ended problems
	projects/extended activities
	group activities
	use of manipulatives
	written explanations
Change Math Instruction/Assessment	
Learning Outcomes	How has the emphasis on mathematical problem solving and reasoning changed from 1992-93 to 1996-97?
	How has the emphasis on mathematical explanations and justifications changed from 1992-93 to 1996-97?
	How has the emphasis for each learning outcome in your mathematics instruction changed from 1992-93 to 1996-97?
	problem solving
	communication
	reasoning
	connections
	How has the emphasis for each learning outcome in your mathematics assessment changed from 1992-93 to 1996-97?
	problem solving
	communication
	reasoning
	connections

Figure VI.1 Hypothesized Dimensions, Measures, and Mathematics Teacher Questionnaire Items – Continued

Problem Type	How has the emphasis for each problem type used in your mathematics classroom changed from 1992-93 to 1996-97?
	open-ended problems
	problems that take a few days or more to complete
	problems emphasizing relationships among mathematics concepts
	problems that integrate other subject areas in math
	problems that apply math to real-life situations
	How has the emphasis for each type of assessment question and activity changed from 1992-93 to 1996-97?
	open-ended problems
	projects/extended activities
	group activities
	use of manipulatives
	written explanations
MSPAP Impact	
	About how much has MSPAP influenced your mathematics classroom activities this year (1996-97)?
	To what extent has MSPAP influenced you to make positive changes in your mathematics instruction?
	To what extent has MSPAP influenced you to make positive changes in your mathematics assessment?
	About how often do you ask your students to solve mathematics tasks similar to those on MSPAP?
	To what extent have you focused on the following strategies in preparing your students for MSPAP?
	increasing the use of MSPAP-like tasks in regular instruction
	increasing the match between the content of instruction and the content of MSPAP
Professional Development Support	
Focus on MSPAP	To what extent did staff development activities address the following?
	purpose of MSPAP
	format of MSPAP tasks
	content and skills assessed by MSPAP
	how to prepare students for MSPAP
	how to interpret and use MSPAP results to improve instruction
	how to explain MSPAP results to students/parents
Amount of Support	To what extent have you had the necessary support and/or resources to enable you to make instructional and assessment changes to better reflect what is expected of students in MSPAP and the Maryland Learning Outcomes?
	support for instruction
	support for assessment

A maximum likelihood estimation procedure was used to estimate three hierarchical models using AMOS (Arbuckle, 1997). Two sets of analyses were conducted. The first set excluded two teacher mean scores, Change Math Instruction-Learning Outcomes and Change Math Instruction-Problem Type, whereas, the second set of analyses included these two scores. Teachers answered the questions with respect to instructional change only if they were a teacher in Maryland since the 1992-93 school year. Thus, the second set of analyses is based on a smaller sample size than the first set of analyses.

For the analyses excluding the instructional change measures, the first model that was estimated provided a test for the hypothesis that one factor accounted for the interrelations among the teacher mean scores for nine measures. The second model that was estimated provided a test for the hypothesis that four factors accounted for the interrelationships as specified in Figure VI.2. The third model that was estimated, the hypothesized model, provided a test for the hypothesis that five factors accounted for the interrelationships as specified in Figure VI.3. For the analyses including the instructional change measures, similar models were estimated as shown in Figures VI.4 and VI.5; however, the third model included six factors so that one factor would reflect the two instructional change measures.

The analyses were done for the on-grade levels (3, 5, 8) combined and the off-grade levels (2, 4, 7) combined. The sample sizes for the analyses excluding the instructional change measures were 254 for the on-grade and 172 for the off-grade. The sample sizes for the analyses including the instructional change measures were 178 for the on-grade and 112 for the off-grade.

Figure VI.2. Four-Factor Model Excluding Instructional Change Measure

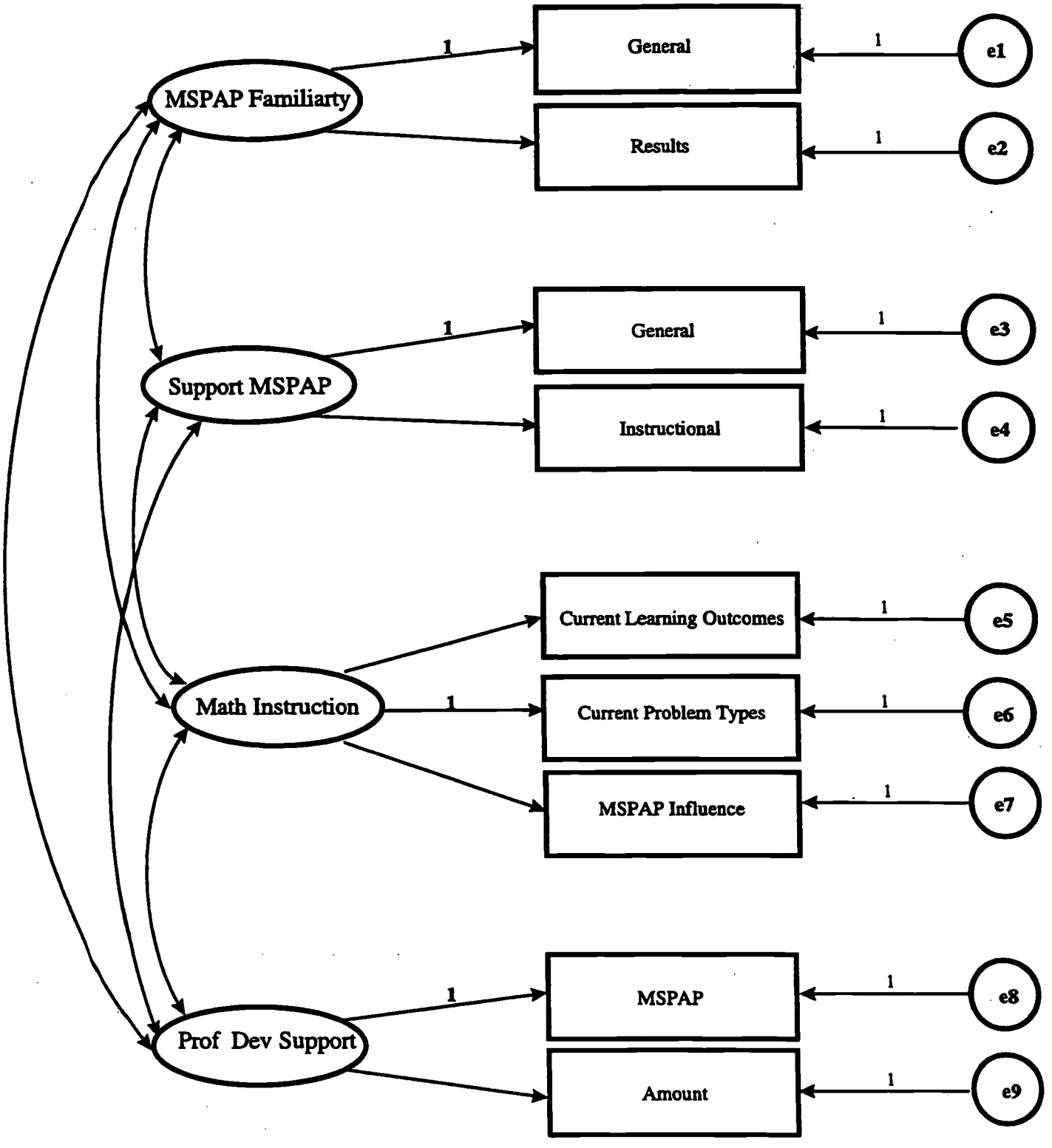


Figure VI.3. Five-Factor Model Excluding Instructional Change Measure

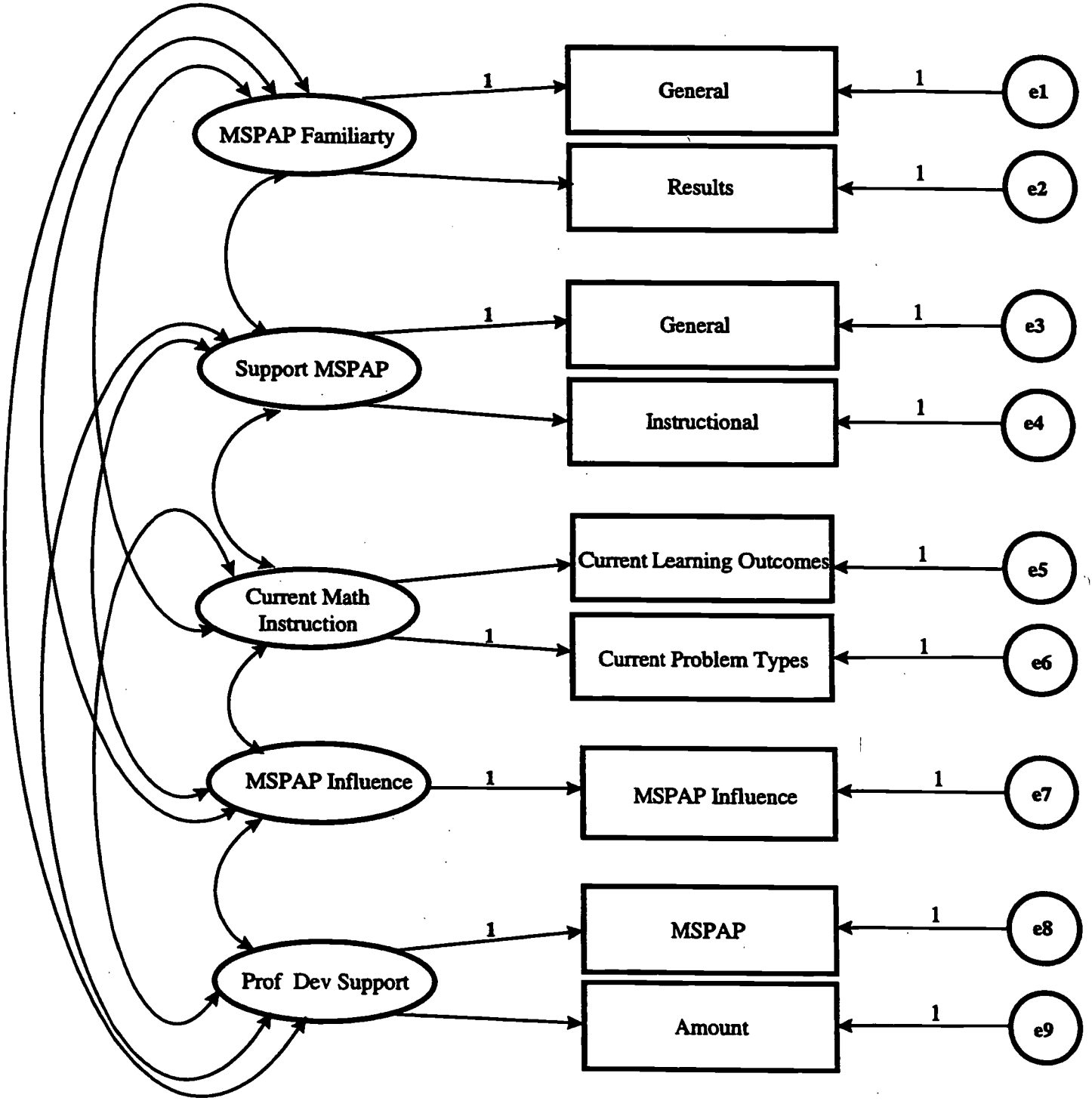


Figure VI.4. Four-Factor Model Including Instructional Change Measure

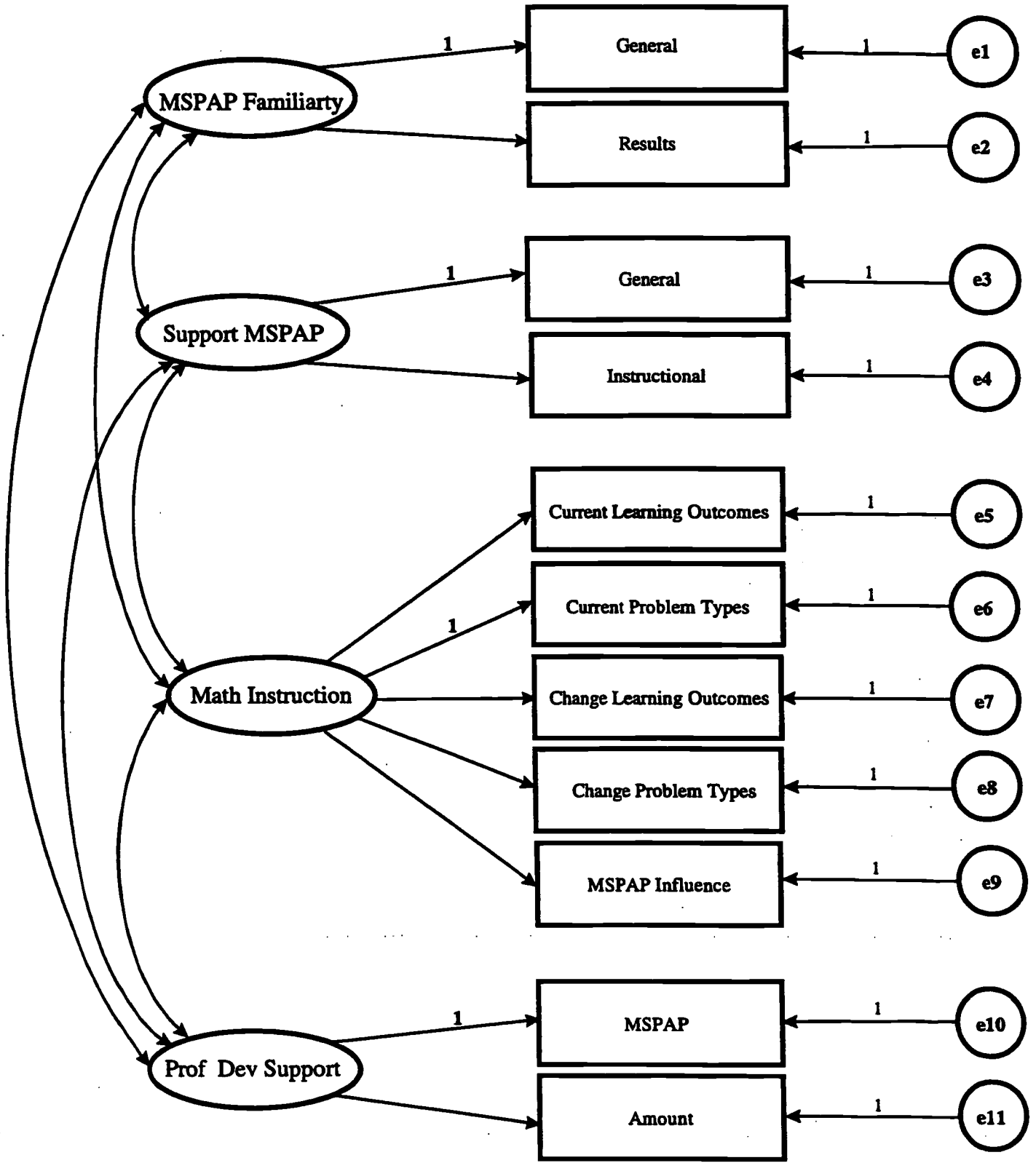
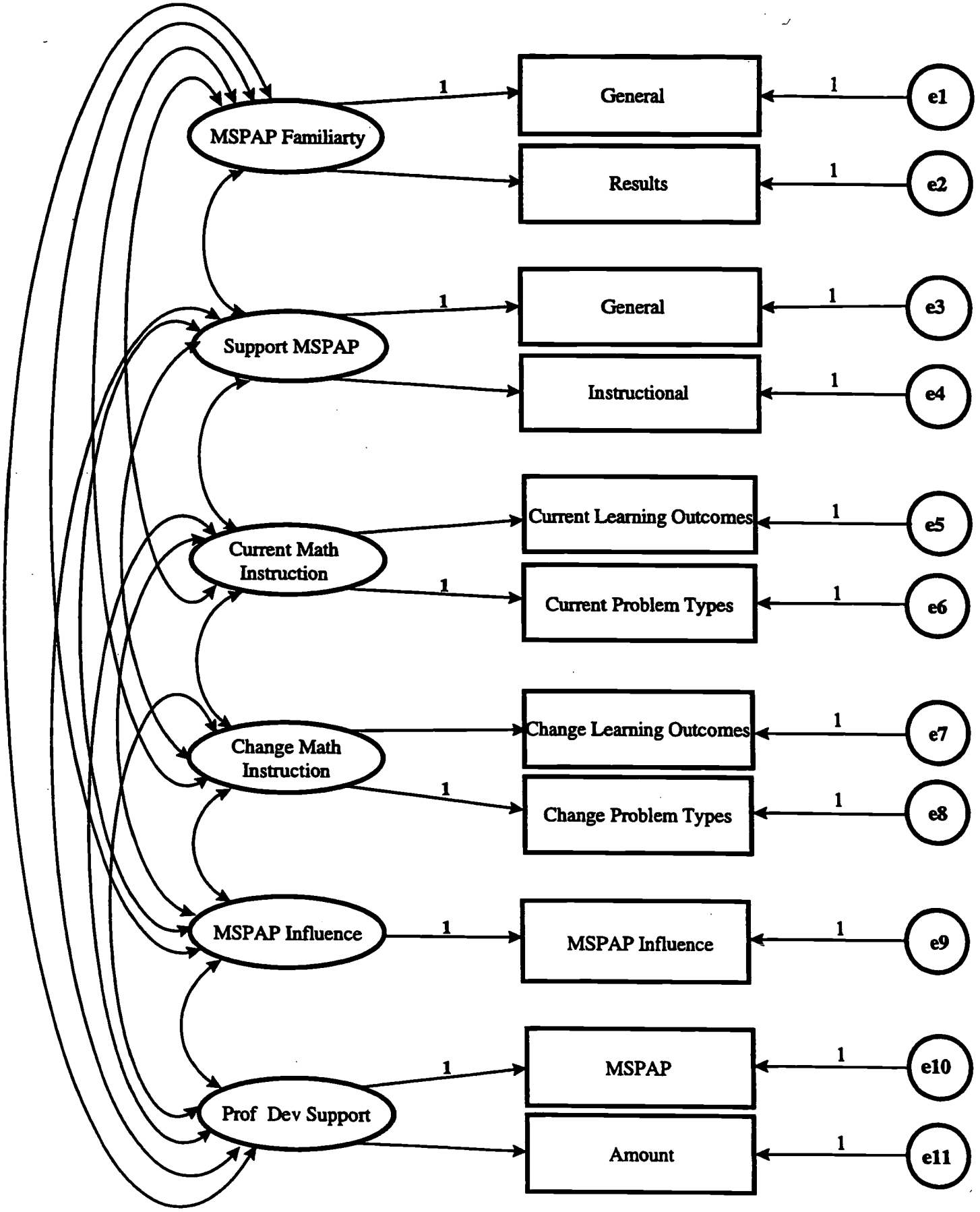


Figure VI.5. Six-Factor Model Including Instructional Change Measure



Results for the Analyses Excluding the Instructional Change Measures

As indicated in Table VI.1, for the on-grade analyses excluding the instructional change measures, the one-factor model and the four-factor model did not fit the data as evidenced by the significant chi-square. The five-factor model fit the data as evidenced by the nonsignificant chi-square statistic. Only one covariance among the factors was not significant and it was for the relationship between Support MSPAP and Current Math Instruction.

Table VI.1 Confirmatory Factor Analysis Excluding Instructional/Assessment Change Measures – Teacher Questionnaire

	χ^2	df	P	RMSEA	NFI
On-grade (n=254)					
1-factor model	258.407	27	.000	.184	.686
4-factor model	63.053	21	.000	.089	.923
5-factor model	18.859	18	.401	.014	.977
Off-grade (n=172)					
1-factor model	150.488	27	.000	.164	.747
4-factor model	40.702	21	.006	.074	.931
5-factor model	18.362	18	.432	.011	.969
On and off grade					
5-factor model					
Constrained	73.634	63	.169	.020	.948
Unconstrained	37.227	36	.412	.009	.974

These analyses were also conducted for the off-grade levels (2, 4, 7), combined. The hypothesized models, excluding the instructional change measures, were estimated to determine whether the underlying structure of the teacher questionnaire was similar for the on- and off- grades. The five-factor model for the off-grade levels, which excluded the instructional change measures fit the data as evidenced by the nonsignificant chi-square statistic in Table VI.1. All of the covariances among the factors were significant.

A third set of analyses was conducted to determine whether the parameters could be constrained across the on- and off-grades for the five factor model. The results are provided in Table VI.1. The difference chi-square of 36.407 with 27 df was not significant ($p = .107$), indicating that the additional parameters estimated under the unconstrained model did not improve on model data fit as offered by the constrained model. Thus, the parameters could be constrained across the two groups. Table VI.2 provides the unstandardized regression coefficients, their standard errors, and the significance tests for the five-factor model with the parameters constrained across the on- and off-grades. The 1's in the

column for the unstandardized regression coefficients denote the necessary constraints to attain model identification.

Table VI.2 Regression Coefficients and Significance Tests for Confirmatory Factor Model with Five Factors - On and Off grade levels (Parameters constrained) – Teacher Questionnaire

Dimension and Measure	Unstandardized Regression coefficients	SE	t
MSPAP Familiarity			
General	1.000		
Results	1.546	.115	13.484*
Support MSPAP			
General	1.000		
Instruction	1.304	.174	7.488*
Current Math Instruction/ Assessment			
Learning outcomes	.835	.056	14.965*
Problem types	1.000		
MSPAP Impact	1.000		
Professional Dev. Support			
MSPAP	1.000		
Amount	.777	.094	8.305*

Note: *p < .01

Results for the Analyses Including the Instructional Change Measures

Similar results were found for the on-grade analyses that included the instructional change measures. The one-factor model and the four-factor model did not fit the data as evidenced by the significant chi-square statistics in Table VI.3. The six-factor model fit the data as evidenced by the nonsignificant chi-square statistic. The only covariance among the factors that was not significant is for the relationship between Support MSPAP and Current Math Instruction.

Table VI.3 Confirmatory Factor Analysis Including Instructional/Assessment Change Measures – Teacher Questionnaire

	χ^2	df	p	RMSEA	NFI
On-grade (n=178)					
1-factor model	319.030	44	.000	.188	.605
4-factor model	183.384	38	.000	.147	.773
6-factor model	34.777	30	.251	.030	.957
Off-grade (n=112)					
1-factor model	232.182	44	.000	.196	.629
4-factor model	140.088	38	.000	.156	.776
6-factor model	41.682	30	.076	.059	.933
On and off grade					
6-factor model					
Constrained	135.607	96	.005	.038	.905
Unconstrained	76.500	60	.074	.031	.947

These analyses were also conducted for the off-grade levels (2, 4, 7) combined. The hypothesized models, including the instructional change measures, were estimated to determine whether the underlying structure of the teacher questionnaire was similar for the on- and off-grades. Similar to the on-grade levels, the one- and four-factor models for the off-grades did not fit the data as evidenced by the significant chi-square statistic in Table VI.3. The six-factor model for the off-grade levels did fit the data as evidenced by the nonsignificant chi-square statistic in Table VI.3. All of the covariances among the factors were significant.

Another set of analyses were conducted to determine whether the parameters could be constrained across the on- and off-grades for the six factor model, including instructional change. The results are provided in Table VI.3. The difference chi-square of 59.107 with 36 df was significant (p=.009), indicating that the additional parameters estimated under the unconstrained model improved on model data fit. Thus, the parameters cannot be constrained across the two groups. Table VI.4 provides the unstandardized regression coefficients, their standard errors, and the significance tests for the six-factor model for the on-grade levels and the off-grade levels.

Table VI.4 Regression Coefficients and Significance Tests for Confirmatory Factor Model with Six Factors - On-grade and Off-grade Levels – Teacher Questionnaire

Dimension and Measure	Unstandardized Regression coefficients		SE		t	
	On-grade	Off-grade	On-grade	Off-grade	On-grade	Off-grade
MSPAP Familiarity						
General	1.000	1.000				
Results	1.509	1.946	.204	.269	7.406*	7.228*
Support MSPAP						
General	1.000	1.000				
Instruction	1.200	1.303	.201	.277	5.958*	4.703*
Current Math Instruction/ Assessment						
Learning outcomes	.830	.628	.080	.080	10.412*	7.858*
Problem types	1.000	1.000				
Change Math Instruction/ Assessment						
Learning outcomes	1.088	.770	.097	.094	11.240*	8.225*
Problem types	1.000	1.000				
MSPAP Impact	1.000	1.000				
Professional Dev. Support						
MSPAP	1.000	1.000				
Amount	.679	.929	.144	.151	4.727*	6.175*

Note: *p<.01

In general, these results suggest that the underlying structure of the teacher questionnaire items for the off-grade levels is similar to the structure for the on-grade levels when excluding the instructional change measures. When including the instructional change measures, the factor structure for the on- and off-grade levels is similar, however the relationship between the measures and the factors differ across the on- and off-grades to some extent.

Multivariate Analysis of Variance for the Questionnaire Data

Results for the Teacher Questionnaire

The teacher questionnaire data were analyzed with a one-way multivariate analysis of variance, with the between-subjects effect being the grade and the dependent measures being the teacher composite mean scores on the dimensions: MSPAP Familiarity, Support MSPAP, Current Math Instruction, Change Math Instruction, MSPAP Impact on Instruction, and Professional Development Support. Descriptive data for the dependent measures are provided in Table VI.5. The range on the questionnaire item scale is 1 - 4, with the more positive responses being at the upper end of the scale. Overall, the mean scores were at the upper end of the score scale.

Table VI.5 Descriptive Data for the Six Dimensions– Teacher Questionnaire

Dimension		Off-Elem (2nd/4th) (n=81)	On-Elem (3rd/5th) (n=120)	Off-Middle (7th) (n=31)	On-Middle (8th) (n=58)
MSPAP Familiarity	mean	3.230	3.393	2.930	3.175
	sd	.572	.566	.673	.562
Support MSPAP	mean	2.639	2.549	2.544	2.508
	sd	.603	.604	.550	.610
Current Math Instruction/ Assessment	mean	3.140	3.296	2.916	2.993
	sd	.493	.393	.360	.486
Change Math Instruction/ Assessment	mean	3.029	3.181	2.962	2.945
	sd	.401	.459	.309	.351
MSPAP Impact	mean	2.964	3.255	2.628	2.818
	sd	.605	.586	.509	.692
Professional Dev Support	mean	2.866	3.080	2.427	2.704
	sd	.621	.575	.616	.756

The multivariate test was significant at $p < .001$ (Wilkes' Lambda, F (18, 795) =3.568, $p < .001$.). Table VI.6 provides a summary of the results of the univariate analyses. As indicated in the table, there were significant grade differences for five of the dimensions: MSPAP Familiarity, Current Math Instruction, Change Math Instruction, MSPAP Impact on Instruction, and Professional Development Support.

Table VI.6 Univariate ANOVA's for the Six Dimensions–
Teacher Questionnaire

Dimension	df	F	p	r^2
MSPAP Familiarity	3	5.956	.001	.049
Support MSPAP	3	.623	.601	.004
Current Math Instruction/ Assessment	3	9.850	.000	.084
Change Math Instruction/ Assessment	3	5.730	.001	.047
MSPAP Impact	3	12.702	.000	.108
Professional Dev. Support	3	10.818	.000	.092

Tukey HSD post-hoc analyses were conducted to determine, for each of the five dependent measures, which differences between composite mean scores were significant. Table VI.7 provides the results of the post-hoc analyses. In general, an examination of the table indicates that composite mean scores for elementary on-grade teachers were significantly greater than composite mean scores for middle on- and off-grade teachers. For example, elementary on-grade teachers, as compared to middle on- and off-grade teachers, were more likely to indicate that they place a greater emphasis in their mathematics classrooms on the learning outcomes and reform oriented problem types as evidenced by the composite mean differences for the dimension, Current Math Instruction. Elementary on-grade teachers, as compared to middle on-grade teachers, were also more likely to indicate that their emphasis on the learning outcomes and reform oriented problem types is greater than what it was a few years ago as evidenced by the mean differences for the variable, Change Math Instruction. Further, elementary on-grade teachers, as compared to middle on- and off-grade teachers, were more likely to indicate that MSPAP had a greater impact on their mathematics instruction and that they had received more professional development support regarding MSPAP as evidenced by the mean differences for the dimensions, MSPAP Impact and Professional Development Support, respectively. As indicated in Table VI.6, however, the adjusted r^2 value is relatively small for each of the significant variables indicating that grade accounts for only a small percentage of the variance.

Table VI.7 Tukey HSD Post-Hoc Analyses – Teacher Questionnaire

Dimension	Contrast	Mean Difference	SE	p
MSPAP Familiarity	3/5 vs 7	.463	.117	.000
Current Math Instruction/ Assessment	3/5 vs 7	.380	.089	.000
	3/5 vs 8	.303	.070	.000
Change Math Instruction/ Assessment	3/5 vs 2/4	.151	.059	.049
	3/5 vs 7	.218	.082	.040
	3/5 vs 8	.236	.065	.002
MSPAP Impact	2/4 vs 7	.336	.128	.043
	3/5 vs 2/4	.291	.087	.005
	3/5 vs 7	.627	.122	.000
	3/5 vs 8	.437	.097	.000
Professional Development Support	2/4 vs 7	.438	.133	.006
	3/5 vs 7	.652	.127	.000
	3/5 vs 8	.376	.101	.001

There were few differences between mean scores for elementary on- and off-grades and when these differences occurred they were small. For example, elementary on-grade teachers, as compared to elementary off-grade teachers, were more likely to indicate that their emphasis on the learning outcomes and reform oriented problem types is greater than what it was a few years ago, as evidenced by the mean differences for the variable, Change Math Instruction. However, the mean difference was small (e.g., .151 , p = .049).

In summary, elementary on-grade teachers as compared to middle on- and off-grade teachers indicated that their instruction was more aligned to the content and format of MSPAP and that they have had more professional development support related to MSPAP. Further, there were only a few differences between elementary on- and off-grade teacher results and no difference between middle on- and off-grade teacher results. In general, this suggests that, within school type (elementary or middle), teachers of grades that were not tested reported similar results as teachers of grades that were administered MSPAP.

Results for the Principal and Student Questionnaire

Elementary and middle school principals were asked to respond to some of the same items as in the teacher questionnaire. Table VI.8 provides elementary and middle school principal mean scores on four of the dimensions discussed above: MSPAP Familiarity, Support MSPAP, MSPAP Impact, and Professional Development Support. This table also provides corresponding mean scores for the teachers. It should be noted that the mean scores for the teachers in this table are somewhat different than the

mean scores provided in Table VI.5. This is because the scores in Table VI.8 are based on only the items that were the same for the principals and the teachers. For the dimensions, MSPAP Familiarity and Support MSPAP, the items were the same for both teachers and principals. For the dimensions, MSPAP Impact and Professional Development Support, the principals had fewer items than the teachers and consequently the teacher means in Table VI.8 are based on a smaller number of items than those reported in Table VI.5.

Table VI.8 Descriptive Data for the Dimensions - Teacher, Principal, and Student Questionnaire

		Teacher				Principal		Class (Students)			
Dimension		Off-Elem ($2^{nd}/4^{th}$) (n=81)	On-Elem ($3^{rd}/5^{th}$) (n=120)	Off-Middle (7^{th}) (n=31)	On-Middle (8^{th}) (n=58)	Elem (n=55)	Middle (n=27)	Off-Elem (4^{th}) (n= 41)	On-Elem (5^{th}) (n=60)	Off- Middle (7^{th}) (n=35)	Off- Middle (8^{th}) (n=53)
MSPAP Familiarity	mean	3.230	3.393	2.930	3.175	3.613	3.475				
	sd	.572	.566	.673	.562	.400	.369				
Support MSPAP	mean	2.639	2.549	2.544	2.508	3.109	3.147				
	sd	.603	.604	.550	.610	.557	.423				
Current Math Instruction/ Assessment	mean	2.8569	3.147	2.652	2.714			2.672	2.759	2.490	2.603
	sd	.486	.472	.481	.554			.314	.271	.227	.302
MSPAP Impact	mean	3.031	3.308	2.734	2.879	3.464	3.191				
	sd	.655	.645	.577	.701	.535	.438				
Professional Dev Support	mean	2.784	3.008	2.581	2.560	3.196	3.080				
	sd	.869	.791	.776	.937	.546	.657				

Note: The teacher sample sizes for the dimension, Current Math Instruction and Assessment, are 41, 60, 35, and 53 for off-elementary, on-elementary, off-middle, and on-middle, respectively. This is because only teachers with corresponding class (students) data were considered for this analysis.

A one-way multivariate analysis of variance was conducted, with the between-subjects effect being the school type and the dependent measures being the composite mean scores on the four dimensions of the principal questionnaire. The multivariate test was not significant (Wilkes' Lambda, F (4, 77) = 2.245, $p = .072$). This result suggests that elementary and middle school principals are similar with respect to their familiarity with MSPAP, their support of MSPAP, the extent to which they think MSPAP has had an impact on instruction, and the extent to which they think their teachers have received professional development support related to MSPAP.

In general, the principal composite mean scores were higher than the teacher composite mean scores on the dimensions as indicated in Table VI.8. A one-way multivariate analysis of variance was conducted, with the between-subjects effect being teacher/principal and the dependent measures being the composite mean scores on the four dimensions of the principal questionnaire. The multivariate test was significant (Wilkes' Lambda, F (4, 367) = 16.510, $p < .001$). Table VI.9 provides a summary of the results of the univariate analyses. All of the univariate tests were significant. Both elementary and middle school principals, as compared to elementary and middle school teachers of mathematics, indicated that they were more familiar with MSPAP, that they were more supportive of MSPAP, that MSPAP had a greater impact on classroom instruction, and that teachers were receiving more professional development support related to MSPAP. It should be noted, however, that the adjusted r^2 values were relatively small.

Table VI.9 Univariate ANOVA's for the Four Dimensions– Teacher vs. Principal

Dimension	df	F	p	r^2
MSPAP Familiarity	1	20.310	.000	.049
Support MSPAP	1	58.581	.000	.134
MSPAP Impact	1	12.783	.000	.031
Professional Dev. Support	1	11.848	.001	.028

Students in 4th, 5th, 7th, and 8th grade were also asked to respond to some of the same items as in the teacher questionnaire related to the dimension, Current Math Instruction. Class composite mean scores for each of the grades were obtained on this dimension and are provided in Table VI.8. A one-way univariate analysis of variance, with the between-subjects effect being the grade level was conducted on the class data. The univariate test was significant as indicated in Table VI.10.

Table VI.10 Univariate ANOVA's for One Dimension– Teacher and Student Questionnaire

	Teacher				Class (Students)			
Dimension	df	F	p	r^2	df	F	p	r^2
Current Math Instruction/ Assessment	3	15.550	.000	.123	3	7.841	.000	.089

Tukey HSD post-hoc analyses were conducted to determine which differences between mean scores were significant. Table VI.11 provides the results of the post-hoc analyses. As indicated in the table, elementary on-grade students (5^{th}) and off-grade students (4^{th}) were more likely to indicate that a greater emphasis was placed on the learning outcomes and reform-oriented problems than off-grade students (7^{th}). Further, on-grade elementary school students (5^{th}) were more likely to indicate that a greater emphasis was placed on the learning outcomes and reform-oriented problems than middle on-grade students (8^{th}). It should be noted, however, that the mean differences, although significant, are relatively small given the 4-point scale. Further, the adjusted r^2 value of .089 is relatively small, indicating that approximately 9% of the variance in the Current Math Instruction variable is accounted for by grade level.

Table VI.11 Tukey HSD Post-Hoc Analyses – Teacher and Student Questionnaire

	Teacher				Class (Students)			
Dimension	Contrast	Mean Diff	SE	p	Contrast	Mean Diff	SE	p
Current Math Instruction/ Assessment	3/5 vs 2/4	.239	.071	.004	4 vs 7	.177	.061	.019
	3/5 vs 7	.500	.099	.000	5 vs 7	.261	.057	.000
	3/5 vs 8	.422	.079	.000	5 vs 8	.159	.050	.008

In general, the composite mean scores for classes on this dimension were consistently lower than the teacher composite mean scores. A one-way univariate analysis of variance, with the between-subjects effect being the class/teacher was conducted on the data. The univariate test was significant, $F(1, 376) = 25.367$, $p < .000$. This suggests that teachers, as compared to students, were more likely to indicate that their mathematics classrooms had a greater emphasis on the learning outcomes and reform oriented problem types. Similar to the previous results, the adjusted r^2 value of .061 is relatively small,

indicating that approximately 6% of the variance in the Current Math Instruction variable is accounted for by the type of respondent (teacher vs. class of students).

VII. MSPAP Performance Gains From 1993-97 in Relation to "MSPAP Impact" and School Characteristic Variables

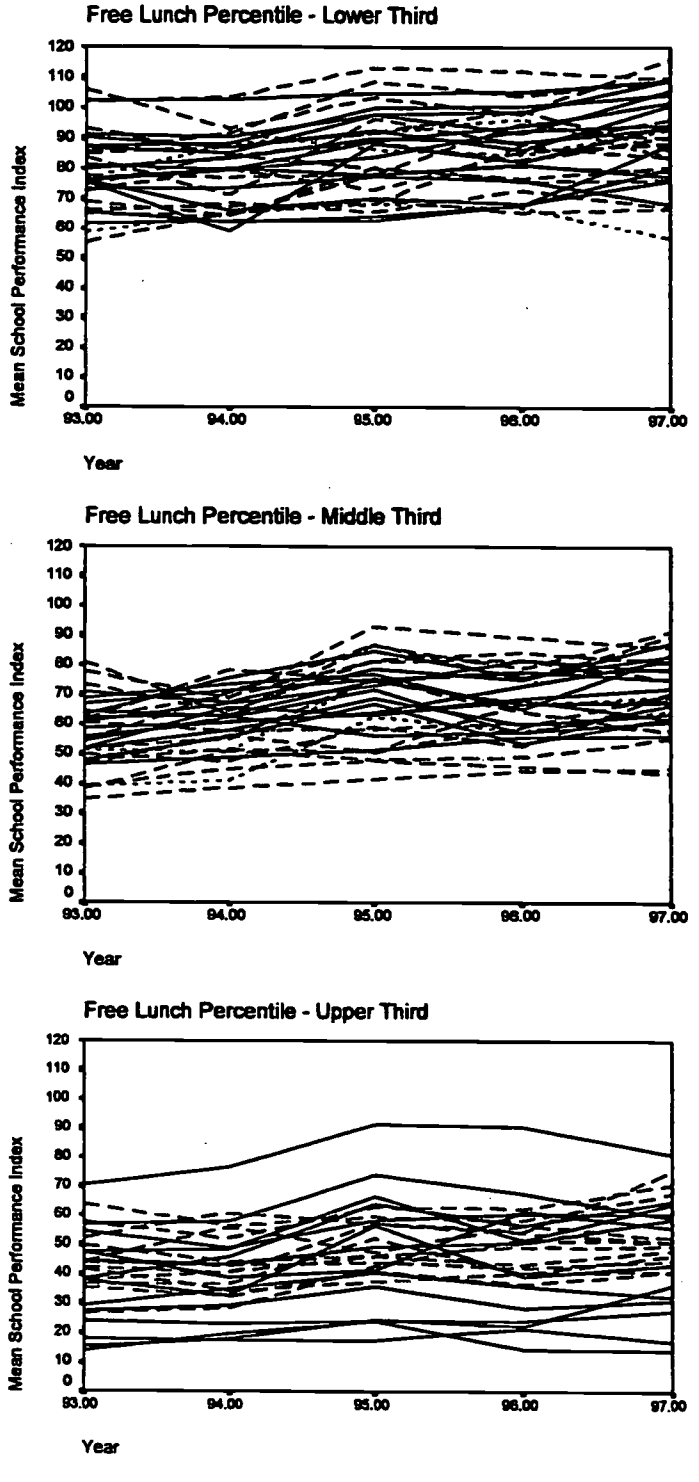
Modeling Differences in School Performance Over Time

Random coefficient or growth modeling was used to examine mathematics performance on MSPAP from 1993 to 1997 in relation to two dimensions from the teacher questionnaire and the variable, percent free or reduced lunch. Only two dimensions, MSPAP Impact and Current Math Instruction, were used because of the relatively small school sample size. In addition, these two dimensions were considered to be more relevant than the other dimensions for examining the relationship between change and teachers' perceptions.

The advantages of using growth curve methodologies to analyze change has been discussed in the literature (c.f., Rogosa & Willet, 1985; Willet & Sayer, 1994; Rogosa, 1987). These methodologies are particularly well suited for studying processes that consider change as continuous with individual differences in the pattern of change (e.g., initial level and rate of growth). Further, these methodologies allow for studying individual differences and identifying factors that affect the trajectory of change. This type of analysis can not be modeled by time-specific comparisons involving group-level (e.g., means) differences.

Figure VII.1 illustrates the differences in initial mean MSPAP performance and changes in mean MSPAP performance from 1993 to 1997 for the sample of schools in the present study. Since percent free or reduced lunch was found to correlate significantly with 1993 MSPAP math performance, the plots are presented for three subgroups of this variable (i.e., lower 3rd, middle 3rd, and upper 3rd) to reduce the number of lines in any one graph. As can be seen, there are differences among the schools in terms of their initial MSPAP math performance and their change over time.

Figure VII.1 Change in School Performance Index Over Time by Percent Free Lunch Percentiles



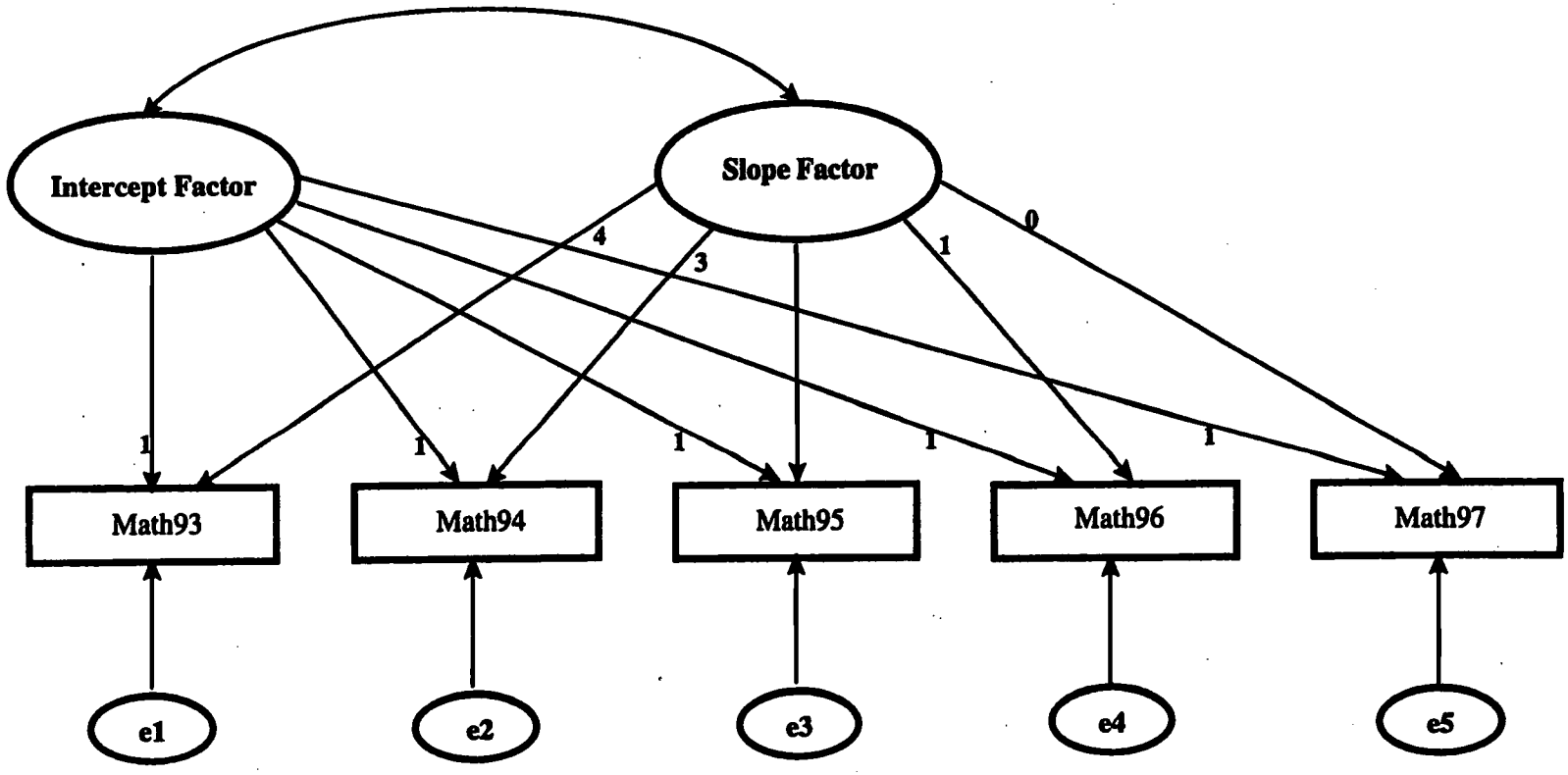
In order to model individual differences in change and assess the correlates or predictors of change, two levels of statistical modeling are required: Level 1 - within individual schools, trends across the repeated measurements are modeled; and Level 2 - across schools, the parameters from the model of individual differences in change at Level 1 are modeled in relation to other factors. At Level 1, growth models analyze the repeated measurements of test scores, analyze the relationship between time (year) and test score levels, and estimate a reference status (intercept) and rate of change (slope) for each school. The parameters from the model at Level 1 (intercepts and slopes) are then modeled in relation to school characteristics to explore the relationship between the reference status of MSPAP performance and changes in performance with the two dimensions of the teacher questionnaire and the variable, percent free or reduced lunch.

One recently developed random coefficient model, the latent variable growth model, was used in this study. Latent variable growth models estimate random coefficient or growth models within the framework of structural equation models (c.f., Meredith & Tisak, 1990; McArdle & Epstein, 1987; Muthen, 1994) and offer several advantages over more traditional growth curve methodologies. First, these models allow the researcher to reflect an underlying theory and evaluate latent variables or theoretical constructs in the processes underlying change. Another advantage to this procedure is that more general analyses can be conducted. Multiple outcome variables with different growth processes can be modeled, individual variability in rates of growth can be modeled as a function of mediating factors, multiple indicator latent factors reflecting theoretical constructs can be defined to model measurement error, and differences in growth can be examined as a function of either a treatment intervention or some other grouping variable. Latent variable growth models can be estimated in currently available structural equation modeling software such as LISREL (Joreskog & Sorbom, 1994) or AMOS (Arbuckle, 1997). These programs provide maximum likelihood estimation of parameter estimates, asymptotic standard errors, goodness-of-fit statistics, and the ability to compare nested models which reflect competing hypotheses. In the present study, AMOS was used.

Figure VII.2 presents the Level 1 latent variable growth model for the present study. This model involves the outcome variable, MSPAP mathematics standard score, measured at five timepoints. In order to translate the growth model into the framework of structural equation modeling, the school-specific random coefficients (intercepts and slopes from Level 1) are each modeled using two latent factors: 1) a factor representing a reference status of MSPAP math performance (intercept), and 2) a factor which corresponds to the rate of change in MSPAP math performance over time (slope). The mean of these factors represent group level estimates (Level 2) of the intercepts and slopes, respectively, and the variance of these factors reflects the school differences or random effects that exist around these

group level parameters. Larger variances reflect increased variability or less similarity in intercept and slopes among the schools.

Figure VII.2. Level I Latent Variable Growth Model



As can be seen from the figure, the Level 1 model has the format of a measurement or confirmatory factor analysis model in structural equation modeling with restrictive loadings: $Y = \Lambda\eta + \varepsilon$, where Y are the original measurements over time, η is a vector of latent variables (intercept and slope parameters), Λ is a matrix of regression coefficients relating the slope and intercept factors to the Y measurements, and ε is a vector of residuals representing variance not accounted for due to time specific factors not included in the model or random error. In addition, an association between the intercept and slope factors is assumed and indicated by the curved bi-directional arrow in the figure.

The meaning of the intercept factor depends on the scaling of the time variable for the slope factor, and the scaling of the slope factor is determined by the factor loadings or regression coefficients relating the slope factor to the observed measurements. For example, to reflect a simple linear pattern, the regression coefficients could be constrained to be 0, 1, 2, 3, and 4 for the variables, 1993 MSPAP performance to 1997 MSPAP performance. Under this scaling, the intercept could be interpreted as MSPAP initial status of schools since time 0 corresponds to 1993 performance. However, it is also possible to estimate coefficients or constrain the parameters to some other pattern. In this figure, the pattern is 4, 3, 2, 1, and 0. Since time 0 is associated with 1997 MSPAP performance, the intercept factor is interpreted as 1997 MSPAP status and a decrease in performance would be expected from 1997 to 1993. This scaling was adopted because other school related information was collected in 1997 and introduced into the analysis to explain variations in the 1997 MSPAP performance and rates of change among schools. The intercept factor will be referred to as 1997 MSPAP performance hereafter.

The structure or distribution of the residuals (Level 1 error models) is defined through constraints on the parameters of the error variance-covariance matrix. The classical assumption of homoscedastic independent errors can be defined by constraining the diagonal elements (variances) of the error variance covariance matrix to be equal over time and off-diagonal elements (covariances) fixed at 0. This assumption can be relaxed by allowing the variances to vary over time and/or estimating a certain pattern to the error variances and covariances (e.g., compound symmetry or adjacent error covariances estimated). In addition, all error variances and covariances can be estimated as in a fully parameterized or unstructured error matrix. In Figure VII.2, independent but unequal error variances are assumed.

In order to estimate group level estimates of the intercept and slope latent variables for the Level 2 model, means for the latent variable intercepts and slope factors must be estimated. The general covariance structure model accommodates such a parameterization and is often used when analyzing longitudinal data or multiple populations. In order to estimate these types of models, the general covariance structure model includes an intercept term as follows: $Y = \tau + \Lambda\eta + \varepsilon$, where τ is a vector of

intercepts and is the E[Y] when $\eta = 0$, and all other model parameters are defined as before. Note that $\tau_0 = 0$ when deviations from means are analyzed.

Table VII.1 presents the results from estimating the Level 1 model in Figure VII.2 for 86 schools (1 aberrant pattern of performance over time was detected and deleted for the growth curve analyses). The chi-square statistic for model-data-fit was 8.162 with 9 *df* (p=.518) indicating that the null hypothesis that the variance-covariance matrix implied by the model in the table equals the observed variance-covariance matrix could not be rejected. As can be seen, the 1997 MSPAP performance (intercept factor) across the schools was 521.612 with a significant mean rate of change (slope factor) of –2.701, although the rate of change was modest given the scale of the test scores. Recall that the rate of change is associated with a decrease in performance from 1997 to 1993. Thus, this result suggests that there was a significant increase in performance from 1993 to 1997. The variances for 1997 MSPAP performance and rate of change indicate significant variability in these parameters across the school. In addition, the covariance between 1997 MSPAP performance and rate of change was not significant (r = -.050). In order to investigate this last finding further, an analysis in which 1993 MSPAP performance was the reference point was examined. This analysis revealed a significant negative covariance between 1993 MSPAP performance and rate of change (r = -.404) indicating that higher rates of change were associated with lower initial performance in 1993. This suggests that the rate of change is more similar for schools in 1997 than in 1993 and this may be due to the observed decrease in variability in 1997 school performance as compared to 1993.

Table VII.1 Results for the Level 1 Growth Model

Measure and variable	Estimates	SE	T
Regression Coefficients:			
Math93<- 1997 Performance	1		
Math94<- 1997 Performance	1		
Math95<- 1997 Performance	1		
Math96<- 1997 Performance	1		
Math97<- 1997 Performance	1		
Math93<- Rate of Change	4		
Math94<- Rate of Change	3		
Math95<- Rate of Change	1.392	.339	4.103
Math96<- Rate of Change	1		
Math97<- Rate of Change	0		
Latent Variable Means:			
1997 Performance	521.612	2.472	211.041
Rate of Change	-2.701	.264	-10.217
Variances/Covariances:			
1997 Perform-Rate of Change	-1.747	6.128	-0.285
1997 Performance	496.663	79.441	6.252
Rate of Change	2.432	1.039	2.342
e1	31.536	9.273	3.401
e2	32.700	6.963	4.696
e3	71.019	12.235	5.805
e4	23.254	5.746	4.047
e5	47.284	10.393	4.550

It should be noted that a non-linear rate of change was estimated in the model. The chi-square difference between a model assuming linear change and the non linear rate of change model described in Table VII.1 was 3.11 with 1 *df* ($p<.10$) and the RMSEA (root mean square error of approximation, Browne and Cudeck, (1993) was reduced by .03. Therefore, a non-linear rate of change in the Level 1 model was assumed.

The structural component of the structural equation model is used to reflect factors which are hypothesized to explain the variability in 1997 MSPAP performance (intercepts) and rates of change (slopes): $\eta = \alpha + \beta\eta + \zeta$; where, η is defined as above, α is a vector of population means for the latent variables, β is a matrix of structural slopes for the effects among endogenous and exogenous η variables (e.g., variables included to explain individual differences in intercepts and slopes), and ζ are structural residuals. In Figure VII.3, two dimensions from the teacher questionnaire and the variable, percent free or reduced lunch were introduced into the growth model and paths are included from these variables to the latent variables (1997 MSPAP performance and rate of change). The structural residuals are given by d1 and d2 in the figure, and the relationship between 1997 MSPAP performance and rate of change is estimated through these two residual parameters. As indicated previously, only two dimensions were

introduced since the school sample size is relatively small (n=86). Also, in theory, it would be possible to incorporate the confirmatory factor analysis model for the teacher questionnaire directly with the growth model rather than use the composite variables for the two dimensions. However, given the sample size in the present study, such a model was overly complex to be estimated.

Figure VII.3. Level II Latent Variable Growth Model

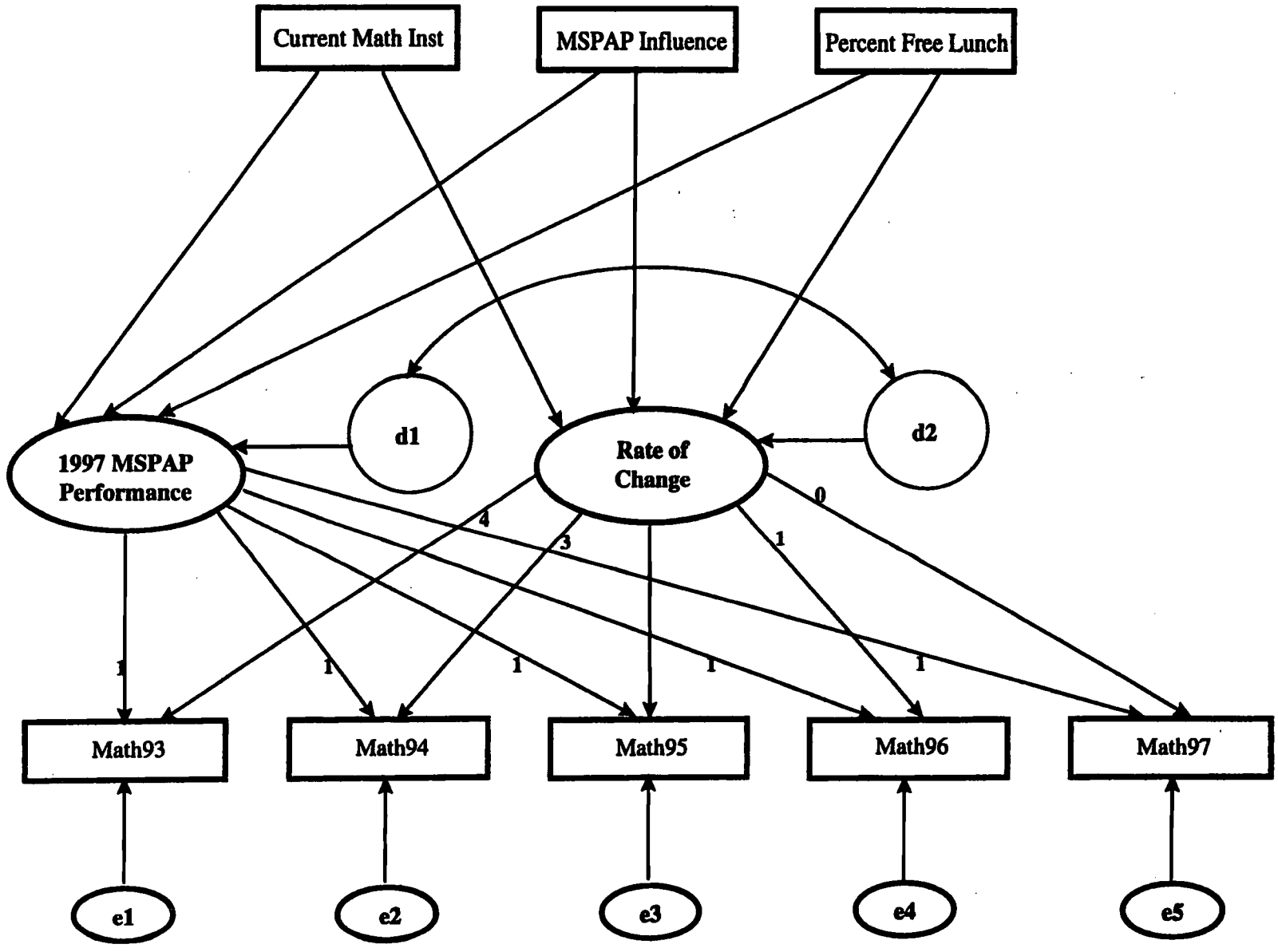


Table VII.2 presents the regression coefficients for the variables introduced to explain variation in 1997 MSPAP performance and changes in performance over time. The chi-square statistic for model-data-fit was 24.989 with 18 *df* (p=.125) indicating that the null hypothesis that the variance-covariance matrix implied by the model in Table VII.2 equals the observed variance-covariance matrix could not be rejected. The RMSEA statistic was .068 which is within the acceptable range (Browne and Cudeck, 1993). As can be seen, the variable Percent Free Lunch is significantly related to 1997 MSPAP performance. Thus, increases in the percentage of students receiving free or reduced lunch is associated with lower levels of MSPAP performance in 1997. The only factor that was found to significantly explain variability in rates of change was the teacher questionnaire dimension, MSPAP Impact. This indicates that higher levels of teacher reports of MSPAP having a direct impact on instruction are associated with greater rates of decrease in performance from 1997 to 1993 or higher levels of rate of change in MSPAP school performance. Finally, it is interesting to note that, although increases in the percentage of students receiving free lunch is associated with lower levels of MSPAP performance in 1997, corresponding increases were not significantly associated with rate of change in MSPAP performance over time.

It is important to note that the school sample size for this analysis was relatively small (n=86) and therefore, the results should be interpreted cautiously and additional studies should be conducted. Data that was collected in the science and social studies areas were based on a larger sample size. Therefore, growth model analyses using these data sets may provide more stable results than the analyses from the mathematics data set.

Table VII.2 Results for the Level 2 Growth Model - Factors Introduced to Explain MSPAP 1997 Performance and Rate of Change

Measure and Variable	Estimates	SE	t
Regression Coefficients			
Effects on 1997 Perform.			
Current Math Inst.	6.929	5.666	1.223
MSPAP Impact	.389	4.164	.093
Percent Free Lunch	-.777	.059	-13.134
Effects on Rate of Change			
Current Math Inst.	1.214	1.023	1.265
MSPAP Impact	-1.580	.752	-2.101
Percent Free Lunch	-.008	.011	-.725

VIII. Descriptive Results from Mathematics Classroom Activities

Results from the mathematics classroom activities are discussed in three major sections: 1) description of classes and teachers, 2) results from the analysis of the instruction, assessment, and MSPAP test preparation activities, and 3) results from the analysis of the classroom scoring schemes. The first section describes the type and heterogeneity of the math classes from which the activities were selected, the sample sizes, the sources of the activities, and rater agreement in coding the activities. In the results section for instruction, assessment, and test preparation activities, information is provided regarding the format of the activities, the extent to which they reflect the Maryland Learning Outcomes, other task features of the activities (e.g., response type required of student, integration with other subject areas, etc.), and their similarity to MSPAP-like tasks. Finally, in the third section, results are provided for the classroom scoring schemes such as the format of the scoring scheme and their evaluation components. The Maryland Learning Outcomes and the format and content of MSPAP tasks served as the basis for the coding schemes that were developed for the analysis of the classroom instruction, assessment, and MSPAP test preparation activities and the scoring schemes.

Description of Classes and Teachers who Collected Classroom Activities

Mathematics teachers were asked to send in approximately 5 to 6 instruction activities, 5 to 6 assessment activities, and 1 sample of a scoring scheme used from September to December 1996. Similarly, in the spring they were asked to send in another set of 5 to 6 instruction activities, 5 to 6 assessment activities, and 1 sample of a scoring scheme used from January to June 1997. In addition, they were also asked to send a sample of a MSPAP test preparation activity used prior to the administration of MSPAP. If the teacher taught more than one mathematics class, they were requested to obtain these materials from a typical class that they taught. A total of 250 mathematics teachers sent in a sample of their mathematics classroom activities used during the 1996-97 school year.

Type of Mathematics Class

Teachers were asked to indicate the type of math class from which their sample of classroom activities was selected. As indicated in Table VIII.1 nearly all the elementary classes were "general math" classes (98%), while only 42% of the middle school classes were "general math" classes. The remaining middle school classes were either prealgebra classes (39%) or algebra classes (15%).

Table VIII.1 Type of Math Class from which the Classroom Materials were Selected

	All Grades n=266*	Elementary n=162	Middle n=104
General Math	76%	98%	42%
Pre-Algebra	15%	0%	39%
Algebra, Algebra I, and Algebra II	5%	0%	15%
Not Indicated	3%	2%	4%

* 16 teachers had a change in the type of math class taught from fall to spring.

Heterogeneity of Mathematics Class

Teachers were also asked to indicate the heterogeneity of the students in the math class from which their sample of classroom activities were selected. As indicated in Table VIII.2 almost 60% of the elementary classes compared to only 25% of the middle school classes were classified by the teacher as heterogeneous. A larger percentage of middle school classes (64%) than elementary classes (33%) were classified as homogenous, either on-grade, above-grade, or below-grade level. Only a very small percentage of the classes were exclusively special education or gifted and talented.

Table VIII.2 Heterogeneity of Math Class from which the Classroom Materials were Selected

	All Grades n=286*	Elementary n=183	Middle n=103
Heterogeneous	47%	59%	25%
Homogenous	44%	33%	64%
On-Grade	24%	19%	33%
Above-Grade	11%	8%	15%
Below-Grade	9%	6%	16%
Exclusively Special Education	6%	6%	6%
Exclusively Gifted/Talented	1%	1%	3%
Not Indicated	2%	2%	3%

* 36 teachers had a change in the level of math class taught from fall to spring.

Sample Sizes for Teachers and Classroom Activities by Grade Level

On average across the entire school year, approximately 16 classroom instruction and assessment activities were collected per teacher. In the fall, 236 mathematics teachers sent in 10 classroom activities on average, and in the spring, 163 mathematics teachers sent in 10 classroom activities on average. For each grade level, Table VIII.3 indicates the number and percentage of teachers who sent in classroom

activities and also the total number and percentage of all classroom activities received. For example, 39 2nd grade teachers sent in a total of 591 classroom activities. The percentages across grades for the number of teachers and the number of activities are somewhat similar, although a slightly smaller percentage of off-grade teachers (2, 4, and 7) than on-grade teachers (3, 5, and 8) sent in classroom activities.

Table VIII.3 Number of Teachers and Classroom Activities by Grade Level

Grade	Teachers		Activities	
	Number	Percentage	Number	Percentage
2	39	15%	591	15%
3	49	19%	854	22%
4	31	12%	454	11%
5	45	18%	698	18%
7	37	15%	639	16%
8	52	21%	712	18%
Total	253*	100%	3948	100%

* 3 teachers changed the grade taught from fall to spring.

Sample Sizes by Type of Classroom Activity

Teachers were provided with labels to attach to each activity indicating the type of activity (e.g., instruction, assessment, test preparation, scoring scheme). Table VIII.4 shows the number and percentage of activities for each type. Across all grades (2, 3, 4, 5, 7, and 8), there was a total of 1940 instruction activities, 1388 assessment activities, and 332 scoring schemes. For grades 3, 5, and 8 there was a total of 125 MSPAP test preparation activities. The table also includes a category called "not coded". These were activities that were not coded for one of two reasons. One reason for not coding an activity was because it pertained strictly to another content area such as social studies or science. Another reason an activity was not coded was because it consisted only of teacher notes or general lesson plans and it was difficult to discern what the students were required to do.

The percentages across grade levels for each of the types of activities were somewhat similar, although slightly more on-grade teachers than off-grade teachers sent in classroom activities. (A table indicating the number and percentage of activities by grade level is included in Appendix A.)

Table VIII.4 Type of Classroom Activity

	Activities		Teachers		Mean Number of Activities Per Teacher
	Number	Percentage	Number	Percentage	
Instruction	1940	49%	245	98%	7.92
Assessment	1388	35%	214	86%	6.49
MSPAP Test Preparation (3, 5,8)	125	3%	51	35%	2.45
Scoring Schemes	332	8%	141	56%	2.35
Not Coded	163	4%	90	36%	1.81

Sources of Classroom Activities

Teachers were also asked to indicate the source of each activity. For each type of classroom activity, Table VIII.5 indicates across all grades the number and percentage of activities from a variety of sources. The results across grades were quite similar. Over half of the instruction activities (57%) were from textbook or commercial resources and 25% were teacher-developed. Approximately equal percentages of the assessment activities were from textbook/commercial resources or were teacher-developed (36% and 38% respectively). While the percentage of activities that were county-developed was quite small for instruction and assessment activities, there was a slightly larger percentage of assessment activities (15%) than instruction activities (8%) that were county developed. The percentage of instruction and assessment activities obtained from state-level materials, such as MSPAP Release Tasks, Maryland Consortium Tasks, and Maryland Performance-Based Exemplars was very small.

When examining the MSPAP test preparation activities, the sources were somewhat different than for the instruction or assessment activities. The percentage of teacher-developed activities was similar (33%), however, there was a larger percentage that were county-developed (26%), MSPAP Release Tasks (4%) and other state-level materials (10%). The sources for the scoring schemes were similar to the test preparation activities. About 35% were teacher developed, 20% were county-developed, and 9% were state-level materials.

Table VIII.5 Sources of Classroom Activity

	Instruction n=1948	Assessment n=1388	MSPAP Test Prep (3rd, 5th, 8th) n=125	Scoring Scheme n=332
Teacher/Other Teacher/ School Developed	25%	36%	33%	35%
Textbook/Commercial Resources	57%	38%	15%	15%
County/Another County Developed	8%	15%	26%	20%
Teacher and Textbook/ Teacher and County Developed	4%	5%	4%	2%
MSPAP Release Tasks	<1%	1%	4%	2%
MD Consortium/ Exemplars	1%	1%	10%	9%
Other/ Teacher and Student/Class (Scoring)	<1%	<1%	1%	<1%
Cannot Be Determined	5%	4%	9%	15%

Rater Agreement

A total of four raters coded the classroom activities. A formal training session was conducted to familiarize the raters with the coding scheme using a sample set of pre-coded activities. Then, the raters coded another set of sample activities independently and their codes were compared and discussed by the group. After the formal training was complete, pairs of raters individually coded a set of classroom activities from a school (elementary or middle) for a certain collection period (fall or spring). The pair of raters met to discuss their discrepancies and reached a consensus on the codes for each activity. This was done to ensure that all raters shared a common understanding of the coding scheme. Thus, for a small percentage of classroom activities (7%), one set of codes, agreed upon by two raters, was obtained.

After it was determined that the raters reached a shared understanding of the coding scheme and were proficient in applying it to a variety of classroom activities, each rater individually coded sets of classroom activities. Approximately 21% of the sets of classroom activities (an elementary or middle school teacher's activities from either fall or spring) were coded individually by two raters. The overall adjusted rate of agreement between the raters was then calculated[2]. See Appendix B for a description of how the adjusted rate of agreement was calculated.) The adjusted rate of agreement was found to be

[2] Percent agreement was considered to be too lenient of an index of rater agreement because for a number of the categories to be coded there were a range of options that could be selected. As an example, for the content learning outcome, one to eight content outcomes could be selected for an activity. However, the majority of the activities had between one to three content outcomes coded. A simple percent agreement based on each of the eight outcomes would have inflated the index for rater
(footnote continued on next page)

84% for the instruction, assessment, and test preparation activities and 81% for the scoring schemes. In addition to examining the agreement between rater pairs, the accuracy of raters' codes was examined for 23% of the sets of classroom activities. This was accomplished by comparing a rater's set of codes with a "valid" set of codes obtained by the lead rater who had been involved in the conceptualization and development of the coding scheme. The adjusted rate of agreement was 87% for the instruction, assessment, and test preparation activities, and 74% for the scoring schemes.

Descriptive Results from Instruction, Assessment, and MSPAP Test Preparation Classroom Activities

Classroom Activity Format

Each of the MSPAP tasks consists of a series of items that are related to the same problem context or situation. Therefore, for the classroom instruction, assessment, and test preparation activities, if all the items within an activity were related to the same problem context or situation (e.g., all items were related to designing rooms in a house), the activity was treated as one task. Whereas, if each item was not related to the same context, the activity was treated as distinct items (e.g., a set of traditional text-book like word problems). Table VIII.6 indicates the percentage of instruction, assessment, and test preparation activities that were considered as a task with related items, as a set of distinct items, and as a sole item. This information is provided for each grade and across grades. In some cases, an activity could be coded as both consisting of a task with several items related to the same context and a set of distinct items. As might be expected, this occurred more often for the classroom assessment activities and the MSPAP test preparation activities as compared to the instruction activities.

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agreement. Thus, an adjusted percent agreement was used. The procedure for obtaining the adjustment is provided in Appendix B.

Table VIII.6 Activity Format for Mathematics Classroom Activities

Instruction	All grades	2nd	3rd	4th	5th	7th	8th
Task with several items related to the same context	47%	38%	48%	49%	53%	47%	48%
Distinct items	54%	57%	50%	56%	53%	55%	54%
Only one item	7%	13%	8%	3%	6%	3%	6%
Assessment							
One task with several items related to the same context	38%	32%	49%	29%	47%	30%	36%
Distinct items	71%	72%	60%	81%	66%	83%	70%
Only one item	7%	11%	6%	6%	6%	8%	7%
MSPAP Test Preparation (3rd, 5th, 8th)							
One task with several items related to the same context	85%	--	90%	--	79%	--	85%
Distinct items	16%	--	10%	--	14%	--	21%
Only one item	6%	--	3%	--	18%	--	2%

All Grades. Across grades, 47% of the instruction activities consisted of a task with several items which were related to the same problem context or situation and 54% of the activities consisted of a set of distinct items. A larger percentage of assessment activities (71%), as compared to instruction activities (54%), consisted of a set of distinct items. In contrast, a very small percentage of MSPAP test preparation activities (16%) consisted of a set of distinct items and most of the MSPAP test preparation activities (85%) consisted of a task with several items related to the same context. As might be expected, the MSPAP test preparation activities tended to be more similar in form to the actual MSPAP tasks, as compared to the classroom instruction and assessment activities.

Differences Across Grades. In general, differences across grades were small. Of particular interest, a larger percentage of instruction and assessment activities from the elementary on-grades (3rd and 5th), as compared to the off-grades (2nd and 4th), consisted of a task with several items related to the same context. This is particularly the case for the assessment activities.

Maryland Learning Process Outcomes

The classroom instruction, assessment, and MSPAP test preparation activities were coded in terms of whether they focused on problem solving and/or reasoning as defined by the MLO's and MSPAP. As indicated previously, if all the items within an activity were related to the same problem context or situation, the activity was treated as one task. If each item was not related to the same context, the activity was treated as distinct items. Thus, when the activity was considered as one task, it was coded as either focusing on problem solving and/or reasoning, or not. Whereas, if the activity was coded as

distinct items, it could be coded into one of three categories: (1) all items with a focus on problem solving and/or reasoning, (2) only some items with such a focus, or (3) no items with such a focus. The table below shows the results for each grade and across all grades.

All Grades. As indicated in Table VIII.7, across the grades, 52% of the classroom instruction activities required problem solving and reasoning to some extent, with 44% of these activities having a predominate focus on problem solving and/or reasoning. Across the grades, 46% of the classroom assessment activities required problem solving and/or reasoning to some extent, with 29% of these having a predominate focus on problem solving and/or reasoning. As might be expected a larger percentage of MSPAP test preparation activities used in the 3rd, 5th, and 8th grade classes (91%), as compared to the instruction and assessment activities, required problem solving and/or reasoning to some extent. Moreover, 84% of the MSPAP test preparation activities primarily focused on problem solving and/or reasoning.

Table VIII.7 Process Learning Outcomes in Mathematics Classroom Activities

Instruction	All Grades	2nd	3rd	4th	5th	7th	8th
Problem solving and/or reasoning	44%	39%	47%	42%	47%	44%	43%
Some items with and some items without problem solving and/or reasoning	8%	8%	7%	10%	12%	6%	8%
No problem solving nor reasoning	48%	53%	46%	49%	41%	51%	49%
Assessment							
Problem solving and/or reasoning	29%	26%	43%	21%	34%	18%	28%
Some items with and some items without problem solving and/or reasoning	17%	16%	15%	20%	18%	23%	12%
No problem solving nor reasoning	54%	58%	42%	59%	48%	59%	60%
MSPAP Test Preparation							
Problem solving and/or reasoning	84%	--	90%	--	86%	--	79%
Some items with and some items without problem solving and/or reasoning	7%	--	3%	--	11%	--	9%
No problem solving nor reasoning	9%	--	8%	--	4%	--	12%

Differences Across Grades. In general, the 3rd and 5th grade (i.e., elementary on-grades) instruction and assessment activities focused on problem solving and/or reasoning more often than the activities in the other grade levels. This is particularly the case for the assessment activities.

Relationship Between Classroom Activities and Questionnaire Responses. The results above are fairly consistent with the results from the student and teacher questionnaires. Overall, 54% of the students indicated that tasks that involved problem solving were used in their classrooms on a daily or

weekly basis, with the elementary grades (3rd and 5th) having a larger percentage than the middle grades (7th and 8th). Depending on grade level, between 67% and 89% of the teachers indicated that they use tasks that emphasize problem solving and reasoning on a daily (between 25% and 45%) or weekly (between 42% and 48%) basis. A larger percentage of 3rd and 5th grade teachers reported that on a daily or weekly basis they emphasized problem solving and reasoning (89%), as compared to 2nd and 4th (83%), 8th (74%), and 7th (67%) grade teachers.

Further, there was a larger percentage of 3rd and 5th grade teachers, as compared to the other grade-level teachers, who indicated that both MSPAP and the MLO's had a "great" impact on their classroom activities and that the impact increased a "great" extent since 1992. When asked specifically about the impact of MSPAP on their instruction and assessment, a larger percentage of 3rd and 5th grade teachers indicated that MSPAP had a moderate or great amount of positive impact on instruction and assessment.

Maryland Learning Content Outcomes

The classroom instruction, assessment, and MSPAP test preparation tasks were also coded in terms of their content emphasis. The Maryland Learning Content Outcomes provided the basis for the classification and are provided in the table below. It should be noted that the 'prealgebra' category was extracted from Maryland's 'algebra' category. For the purpose of this analysis, 'prealgebra' included the evaluation of expressions and order of operations, and 'algebra' was restricted to working with unknowns. All other categories were defined according to the Maryland Learning Outcomes.

All Grades. Each activity, regardless if it was one task or a set of distinct items, could be coded for more than one content outcome. Thus, a content outcome had one or more opportunities to be selected for an activity. Of the 1,940 instruction activities, 80% (1,550) were coded solely for one content outcome, 17% were coded for two content outcomes, and 3% were coded for three content outcomes. The table below indicates the percentage of times across all grade levels that an activity was coded for each of the content outcomes when one, two, and three content outcomes were coded per activity. (Similar tables of results for each grade level are provided in Appendix C.) The majority of instruction, assessment, and MSPAP test preparation activities were coded for only one content outcome. As might be expected, however, a larger percentage of assessment and test preparation activities (34%), as compared to instruction activities (20%), were coded for more than one content outcome. It should be noted that 3% of the assessment activities and 4% of the test preparation activities were coded for four or more content outcomes.

The last column in the table, labeled 'overall', indicates the percentage of times each of the content outcomes were coded for an activity regardless if one, two, or three content outcomes were coded per activity. For example, for those instruction activities in which only one content outcome was selected,

numbers and operations was selected for 54% of the activities and it was not selected for 46% of those activities; for those activities in which two content outcomes were selected, numbers and operations was selected for 74% of the activities and it was not selected for 26% of those activities; and for those tasks in which three content outcomes were selected, numbers and operations was selected for 92% of the activities and it was not selected for 8% of those activities. Lastly, regardless of whether one, two, or three content outcomes were selected, numbers and operations was selected for 59% of the activities and it was not selected for the 41% of them.

As suggested in Table VIII.8, numbers and operations was emphasized more often than the other content outcomes in the classroom, instruction, assessment and test preparation activities. In general, geometry/measurement was the next most emphasized content outcome, with statistics being the third most emphasized content outcome. For example, overall, 59% of the instruction tasks were coded for numbers and operations, 27% of the instruction tasks were coded for geometry/measurement, and 19% were coded for statistics. It should be noted that although numbers and operations was the most frequently occurring content outcome selected for MSPAP test preparation activities, overall, the content outcomes of geometry/measurement, statistics, probability and patterns/relationships were selected more often for test preparation activities than for the instruction and assessment activities. Overall, 49% of the test preparation tasks were coded for numbers and operations, 39% of the test preparation activities were coded for geometry/measurement, and 29% were coded for statistics[3].

[3] When more than one content outcome was selected, the content area that was emphasized primarily was indicated. However, if there was an equal emphasis in the content areas that were selected, it was indicated as such. For those tasks in which more than one content area was selected, the results were consistent with those in the table, in that, numbers and operations was chosen most often as the primary emphasis, followed by geometry/measurement and then, statistics.

Table VIII.8 Content Learning Outcomes for Mathematics Classroom Activities - All Grades

	Number Of Learning Outcomes Selected			Overall
	One	Two	Three	
Instruction	n=1,550 (80%)	n=320 (17%)	n=49 (3%)	
Numbers and Operations	54%	74%	92%	59%
Geometry/ Measurement	21%	48%	74%	27%
Statistics	14%	34%	43%	19%
Probability	5%	15%	20%	7%
Pattern and Relationships	2%	10%	25%	5%
Prealgebra	1%	4%	14%	2%
Algebra	3%	16%	33%	6%
None	1%	0%	0%	<1%
Assessment	n=916 (66%)	n=317 (23%)	n=117 (8%)	
Numbers and Operations	58%	80%	96%	67%
Geometry/ Measurement	19%	45%	58%	30%
Statistics	12%	27%	35%	20%
Probability	3%	6%	15%	6%
Pattern and Relationships	1%	10%	23%	6%
Prealgebra	1%	8%	25%	6%
Algebra	4%	25%	48%	14%
None	1%	0%	0%	1%
MSPAP Test Preparation	n=80 (66%)	n=28 (23%)	n=13 (11%)	
Numbers and Operations	38%	61%	77%	49%
Geometry/ Measurement	24%	57%	77%	39%
Statistics	19%	39%	54%	29%
Probability	11%	21%	38%	18%
Pattern and Relationships	1%	14%	38%	10%
Prealgebra	0%	0%	0%	2%
Algebra	6%	7%	15%	7%
None	1%	0%	0%	1%

Relationship Between Classroom Activities and Questionnaire Responses. The order of emphasis for the content outcomes is fairly consistent with what was reported in the teacher questionnaires. The majority of the teachers indicated in the questionnaires that they emphasized numbers and operations the most, followed by geometry/measurement, patterns/algebra, statistics, and probability.

Differences Across Grades. Table VIII.9 shows the overall percentages for each grade level. The overall percentages reflect the percentage of times each of the content outcomes was coded for an activity regardless if one, two, or three content outcomes were coded per activity. As might be expected, none of the elementary instruction, assessment, and test preparation activities were coded for algebra and only a very small percentage were coded for prealgebra. Although prealgebra and algebra were more predominant in the middle school grades, especially 8th grade, numbers and operations was the most often coded content outcome for the middle school activities. However, in general, the percentage of

activities that were coded for numbers and operations decreased across grades, from the 2nd grade to the 8th grade.

Table VIII.9 Content Learning Outcomes for Mathematics Classroom Activities- For Each Grade

Instruction	All grades	2nd	3rd	4th	5th	7th	8th
Numbers and Operations	59%	65%	63%	66%	58%	54%	45%
Geometry/ Measurement	27%	22%	27%	26%	30%	28%	31%
Statistics	19%	18%	18%	15%	24%	18%	19%
Probability	7%	6%	8%	7%	9%	9%	5%
Pattern and Relationships	5%	7%	4%	7%	5%	2%	4%
Pre-Algebra	2%	0%	0%	<1%	1%	4%	7%
Algebra	6%	0%	0%	1%	1%	16%	19%
None	<1%	1%	<1%	<1%	0%	<1%	1%
Assessment							
Numbers and Operations	67%	77%	69%	76%	68%	68%	50%
Geometry/ Measurement	30%	24%	30%	32%	40%	29%	26%
Statistics	20%	17%	22%	14%	25%	17%	20%
Probability	6%	4%	5%	3%	9%	5%	6%
Pattern and Relationships	6%	10%	9%	4%	8%	4%	2%
Pre-Algebra	6%	0%	<1%	0%	1%	17%	14%
Algebra	14%	1%	<1%	1%	2%	37%	40%
None	1%	<1%	1%	1%	2%	1%	1%
MSPAP Test Preparation							
Numbers and Operations	49%	--	59%	--	54%	--	40%
Geometry/ Measurement	39%	--	49%	--	43%	--	31%
Statistics	29%	--	26%	--	32%	--	29%
Probability	18%	--	5%	--	21%	--	24%
Pattern and Relationships	10%	--	21%	--	11%	--	2%
Pre-Algebra	2%	--	0%	--	7%	--	0%
Algebra	7%	--	0%	--	0%	--	16%
None	1%	--	0%	--	4%	--	0%

Other Task Features

In addition to the process and content outcomes, other features of the classroom activities were coded including: interpretation of graphs, tables, or charts; integration with other subject areas; use of realistic contexts; use of manipulatives, calculators, and computers; and the type of response required by students. The analysis of instruction, assessment, and test preparation activities by these features provide additional information for describing their similarity to MSPAP tasks.

Interpretation of Graphs, Tables, or Charts. MSPAP tasks that assess mathematical problem solving and reasoning often require students to interpret information represented in graphs, tables, or charts. Table VIII.10 indicates the percentage of classroom instruction, assessment, and test preparation

activities that required students to interpret information in graphs, tables, or charts. Across the grades, 27% of the instruction activities, 30% of the assessment activities, and 56% of the MSPAP test preparation activities required students to interpret information in graphs, tables, or charts.

Table VIII.10 Interpreting Graphs, Tables, or Charts within Mathematics Classroom Activities

Instruction	All Grades	2nd	3rd	4th	5th	7th	8th
Yes	27%	21%	23%	27%	30%	31%	33%
No	73%	79%	78%	73%	70%	69%	67%
Assessment							
Yes	30%	28%	36%	20%	39%	25%	27%
No	70%	72%	65%	80%	61%	75%	73%
MSPAP Test Preparation							
Yes	56%	--	72%	--	43%	--	52%
No	44%	--	28%	--	57%	--	48%

Differences Across Grades. The percentage of instruction activities that required students to interpret information in graphs, tables or charts was similar across the grades. However, a slightly larger percentage of 3rd and 5th grade assessment activities and a relatively larger percentage of 3rd grade MSPAP test preparation activities required interpreting information from graphs, tables, or charts.

Integration with Other Subject Areas. The majority of the MSPAP tasks that assess mathematics are integrated with other subject areas including, science, social studies, reading, writing, and language usage. Therefore, the mathematics classroom activities were analyzed in terms of whether they were integrated with other subject areas. The integration categories include science, social studies, reading, writing, art, and glyphs/tesselations. An activity was coded for reading if the student was required to read a story or other type of reading material prior to solving the mathematics problem. Integration with writing was selected if the activity required students to provide short explanations or long explanations, to create or pose mathematics problems, or to write a letter or persuasive paragraph based on the mathematics problem. Art was selected if the student was asked to paint, create a model, or the like. If students were required to create a glyph or tessellation this was also coded as a form of integration because it required some level of artistic expression; however, it was coded as its own category.

Each activity, regardless if it was one task or a set of distinct items, could be coded for more than one category for integration. Of the 1,940 instruction activities, 13% were coded for more than one integration category. Of the 1388 assessment activities, 10% were coded for more than one integration category. Whereas, 38% of the MSPAP test preparation activities that were coded for more than one integration category. Table VIII.11 indicates the percentage of times each category of integration was

coded for an activity when one or more integration categories were coded. The table also indicates the percentage of times the activities required no integration.

Across grades, 40% of the mathematics instruction activities and 33% of the assessment activities were integrated with other subject areas, while 82% of the test preparation activities were integrated with other subject areas. The most common forms of integration regardless of the type of activity were within the writing area. Overall, 36% of the instruction activities, 30% of the assessment activities, and 78% of the MSPAP test preparation activities involved writing. As an example, for the instruction activities, 27% were coded for short explanations, 10% were coded for long explanations, 5% were coded for posing mathematical problems, and 5% were coded for writing a letter or persuasive paragraph. It should be noted again that an activity could be coded for more than one type of writing. Although differences across grades were rather small, there were slightly higher percentages of activities requiring long explanations or writing letters/persuasive paragraphs in the middle school grades than the elementary school grades, especially for the assessment activities.

Table VIII.11 Integration of other Subject Areas in Mathematics Classroom Activities

Instruction	All Grades	2nd	3rd	4th	5th	7th	8th
Science	4%	3%	3%	2%	6%	6%	4%
Social Studies	2%	1%	1%	2%	3%	2%	2%
Reading Materials	2%	1%	4%	2%	1%	1%	3%
Writing							
Short Explanations	27%	18%	28%	27%	31%	28%	29%
Long Explanations	10%	7%	9%	7%	10%	11%	14%
Creating/Posing Math Problems	5%	4%	7%	6%	6%	5%	2%
Letters/Persuasive Paragraphs, etc.	5%	4%	5%	5%	4%	7%	6%
Language Usage	1%	1%	1%	0%	0%	1%	0%
Art	1%	0%	1%	0%	1%	2%	2%
Glyphs/Tesselations	2%	3%	5%	2%	2%	0%	1%
No Integration	60%	58%	41%	51%	40%	41%	41%
Assessment							
Science	2%	3%	2%	3%	3%	1%	1%
Social Studies	1%	1%	1%	3%	1%	0%	1%
Reading Materials	1%	0%	1%	0%	0%	0%	2%
Writing							
Short Explanations	23%	16%	37%	16%	25%	20%	21%
Long Explanations	9%	5%	7%	3%	8%	10%	18%
Creating/Posing Math Problems	3%	3%	3%	3%	3%	3%	1%
Letters/Persuasive Paragraphs, etc.	5%	1%	5%	2%	5%	8%	9%
Language Usage	1%	1%	0%	1%	0%	2%	1%
Art	1%	0%	0%	0%	2%	1%	1%
Glyphs/Tesselations	1%	0%	2%	1%	2%	0%	1%
No Integration	67%	69%	43%	71%	53%	57%	47%
MSPAP Test Preparation							
Science	10%	--	21%	--	4%	--	5%
Social Studies	6%	--	10%	--	4%	--	5%
Reading Materials	2%	--	5%	--	4%	--	0%
Writing							
Short Explanations	65%	--	69%	--	71%	--	59%
Long Explanations	34%	--	23%	--	32%	--	41%
Creating/Posing Math Problems	2%	--	0%	--	4%	--	3%
Letters/Persuasive Paragraphs, etc.	17%	--	10%	--	32%	--	14%
Language Usage	2%	--	5%	--	0%	--	0%
Art	2%	--	3%	--	0%	--	2%
Glyphs/Tesselations	2%	--	8%	--	0%	--	0%
No Integration	18%	--	0%	--	0%	--	0%

Relationship Between Classroom Activities and Questionnaire Responses. Overall, 50% of the teachers reported on the questionnaire that they use integrated tasks on a daily or weekly basis which is fairly consistent with the results for the classroom activities. However, only 26% of the students

indicated that they work on integrated tasks on a daily or weekly basis. It may be the case that students do not perceive tasks that require writing as being integrated with another subject area.

Use of a Realistic Context. In general, MSPAP mathematics tasks are set in a realistic context; therefore, the classroom mathematics activities were analyzed in terms of whether they pertained to real-life situations, or not. As indicated previously, if all items within an activity were related to the same context or situation, the activity was treated as one task. If each item was not related to the same context, the activity was treated as distinct items. Thus, when the activity was considered as one task, it was coded as either embedded in a realistic context, or not. Whereas, if the activity was coded as distinct items, it could be coded into three categories: (1) all items embedded in a realistic context, (2) only some items were embedded in a realistic context, or (3) no items were embedded in a realistic context.

As indicated in Table VIII.12, across grades, 50% of the instruction activities and 58% of the assessment activities were embedded in a realistic context to some extent. A higher percentage of MSPAP test preparation activities (80%) were embedded in a realistic context to some extent. In general, differences across grades were small.

Table VIII.12 Realistic Context Used in Mathematics Classroom Activities

Instruction	All Grades	2nd	3rd	4th	5th	7th	8th
Yes	39%	34%	39%	36%	41%	45%	39%
Yes for some items, no for others	11%	4%	8%	15%	18%	9%	11%
No	50%	62%	53%	49%	42%	46%	50%
Assessment							
Yes	27%	28%	37%	22%	27%	18%	28%
Yes for some items, no for others	31%	31%	27%	36%	35%	35%	25%
No	42%	41%	36%	42%	39%	47%	48%
MSPAP Test Preparation							
Yes	74%	--	82%	--	71%	--	71%
Yes for some items, no for others	7%	--	5%	--	4%	--	7%
No	20%	--	13%	--	25%	--	22%

Relationship Between Classroom Activities and Questionnaire Responses. The results above are somewhat consistent with the results from the teacher questionnaire. Overall, 50% of the instruction activities and 58% of the assessment activities were embedded in a realistic context, to some extent, and 78% of the teachers on the questionnaire indicated that they use realistic activities on a daily (32%) or weekly (46%) basis. However, only 46% of the students indicated on the questionnaire that they work on activities that are set in a realistic context on a daily or weekly basis.

Use of Manipulatives, Calculators, and Computers. Many of the MSPAP tasks require students to use manipulatives. Table VIII.13 indicates the percentage of classroom instruction, assessment, and test preparation activities that were coded for the use of manipulatives, calculators, and/or computers. It should be noted that each activity could be coded for more than one of these categories, although this occurred infrequently. For 98% of the instruction and assessment activities, only one category was coded. Similar for 97% of the test preparation activities, only one category was coded. As indicated in the table, manipulatives were coded for 28% of the instruction activities, 15% of the assessment activities, and 25% of the MSPAP test preparation activities. Calculators were coded less frequently and evidence for the use of computers in the activities was rare.

The results indicate that the percentage of activities requiring the use of manipulatives, calculators, and computers appears to be rather small. However, it is possible that their actual use in the classroom activities occurred more frequently than represented here. Manipulatives, calculators, and computers were coded when there was an explicit mention of their use somewhere in the activity, and teachers were not specifically asked to indicate whether they were used. Therefore, it may be the case that they were available for students to use in the classroom even though they were not explicitly written into the classroom activity.

Table VIII.13 Manipulatives, Calculators and Computers Used with Mathematics Classroom Activities

Instruction	All Grades	2nd	3rd	4th	5th	7th	8th
Manipulatives	28%	32%	32%	25%	24%	27%	23%
Calculators	4%	1%	6%	6%	4%	4%	4%
Computers	1%	0%	1%	0%	0%	1%	1%
None	69%	68%	64%	71%	73%	70%	73%
Assessment							
Manipulatives	15%	24%	19%	12%	18%	8%	10%
Calculators	3%	1%	4%	1%	3%	3%	5%
Computers	0	0%	0%	1%	0%	0%	0%
None	83%	76%	78%	88%	80%	89%	88%
MSPAP Test Preparation							
Manipulatives	25%	--	18%	--	18%	--	33%
Calculators	15%	--	28%	--	7%	--	10%
Computers	0%	--	0%	--	0%	--	0%
None	63%	--	54%	--	79%	--	62%

Differences Across Grades. A slightly larger percentage of the instruction activities in the 2nd and 3rd grades, as compared to the other grades, required the use of manipulatives. With regard to the assessment activities, elementary grades, and in particular the 2nd grade required manipulatives more often than the middle grades. It is interesting to note that a very small percentage of the 8th grade

assessment activities required manipulatives (10%); whereas, the 8th grade test preparation activities, as compared to the other on-grades, were coded the most for the use of manipulatives (33%).

Relationship Between Classroom Activities and Questionnaire Responses. The questionnaires asked both students and teachers how often their instruction and assessment activities involve manipulatives. Overall, 59% of the teachers indicated on the questionnaire that they used instruction activities that involve manipulatives on a daily or weekly basis, and 48% indicated that they use manipulatives with assessment activities on a weekly basis. Whereas 30% of the students indicated that they work on instruction activities that involve manipulatives on a daily or weekly basis, and only 13% indicated that they work on assessment activities that involve manipulatives. The student results, as compared to the teacher results, appear to be more consistent with the classroom activity results. However, as mentioned before teachers may have provided us with classroom activities in which students used manipulatives, but it was not apparent when examining the activities. Further, elementary school teachers and students, as compared to middle school teachers and students indicated on the questionnaire that they use manipulates more often which is fairly consistent with the classroom activity results.

Response Required of Student. The MSPAP tasks that are scored for mathematics require students to respond in a variety of ways including providing numerical values, short answers, short and long explanations, and graphs. The mathematics classroom activities were coded according to response type to examine the extent to which they reflect MSPAP response types. Each classroom activity, regardless if it was one task or a set of distinct items, could be coded for more than one response type. Thus, a response type had one or more opportunities to be selected for an activity. Across grades, of the 1,940 instruction activities, 34% (664) were coded solely for one response type, 30% were coded for two response types, 18% were coded for three response types, 10% were coded for four response types, and 6% were coded for five response types. It should be noted that approximately 2% of the activities were coded for more than five response types which are not reflected in the table. These percentages are similar for the assessment activities, however a larger percentage of test preparation activities were coded for more than one response type (88%). Table VIII.14 indicates the percentage of times an activity was coded for each of the response types when one, two, three, four or five response types were coded per activity across all grade levels. Tables summarizing results for each grade are provided in Appendix D. The last column in the table, labeled 'overall', indicates the percentage of times an activity was coded for each of the response types regardless if one, two, three, four, five, or more response types were coded per activity.

As might be expected, the numerical value category was coded more often than the other response types. Overall and across grades, approximately 74% of the instruction, assessment, and test preparation activities were coded for requiring a numerical value. For the instruction activities, the next most

frequently coded categories were short answer (29%), short explanation (27%), and making a chart, table, or graph (24%). For the assessment activities, the next most frequently coded categories were short answer (31%), multiple choice (29%), short explanation (23%), and the requirement for students to show their work (22%). For the 3rd, 5th, and 8th grade test preparation activities short explanation (65%) was the most frequently coded category, making a chart, table or graph (53%), short answer (38%), long explanation (34%), and show work (32%) were the next most frequently coded categories. As might be expected, the response types that were coded for the MSPAP test preparation activities, as compared to those coded for the instruction and assessment activities, are more similar to the response types of MSPAP tasks. It should be noted that a long explanation was defined as a paragraph or more, whereas a short explanation was defined as less than a paragraph and most typically, one or two sentences. Also, for the category 'show work', the activity had to include an explicit statement requiring the students to show their work in order to be coded as such.

Table VIII.14 Response Type for Mathematics Classroom Activities - All Grades

	Number of Response Types Selected					Overall
	One	Two	Three	Four	Five	
Instruction	n=664 (34%)	n=586 (30%)	n=343 (18%)	n=187 (10%)	n=116 (6%)	
Multiple Choice/Matching	9%	11%	15%	12%	16%	12%
Short Answer	7%	29%	40%	52%	64%	29%
Numerical Value	60%	75%	84%	90%	91%	74%
Expression	2%	7%	12%	13%	14%	8%
Making a Chart/Table/Graph	9%	16%	29%	55%	63%	24%
Show Work	<1%	15%	24%	27%	47%	15%
Short Explanation	2%	15%	45%	66%	87%	27%
Long Explanation	3%	6%	9%	23%	37%	10%
Creating/Posing Math Problems	1%	4%	9%	8%	9%	5%
Figural Patterns/Diagrams	4%	10%	12%	16%	18%	10%
Measuring	0%	6%	12%	17%	28%	8%
Modeling/Experiments	1%	1%	1%	7%	8%	3%
Oral	0%	4%	4%	11%	10%	4%
Other*	3%	2%	4%	4%	9%	45
Assessment	n=452 (33%)	n=383 (28%)	n=284 (21%)	n=156 (11%)	n=71 (5%)	Overall
Multiple Choice/Matching	37%	17%	27%	31%	32%	29%
Short Answer	3%	29%	46%	62%	69%	31%
Numerical Value	47%	78%	87%	94%	93%	73%
Expression	<1%	9%	14%	17%	31%	11%
Making a Chart/Table/Graph	5%	13%	25%	33%	39%	18%
Show Work	<1%	18%	33%	44%	56%	22%
Short Explanation	2%	15%	32%	53%	69%	23%
Long Explanation	3%	4%	9%	16%	38%	9%
Creating/Posing Math Problems	<1%	2%	2%	7%	9%	3%
Figural Patterns/Diagrams	<1%	4%	7%	21%	27%	8%
Measuring	0%	4%	9%	10%	21%	6%
Modeling/Experiments	0%	1%	1%	3%	4%	1%
Oral	0%	3%	5%	6%	9%	3%
Other*	2%	3%	3%	5%	3%	3%

*Other: Journal, Categorizing/Ranking, and Cannot Determine

Table VIII.14 Response Type for Mathematics Classroom Activities - All Grades (cont.)

	Number of Response Types Selected					Overall
	One	Two	Three	Four	Five	
MSPAP Test Preparation	n=15 (12%)	n=14 (11%)	n=32 (26%)	n=36 (29%)	n=15 (12%)	
Multiple Choice/Matching	0%	0%	3%	11%	13%	6%
Short Answer	0%	21%	19%	39%	80%	38%
Numerical Value	54%	43%	72%	83%	93%	74%
Expression	0%	0%	9%	11%	7%	8%
Making a Chart/Table/Graph	13%	21%	50%	56%	93%	53%
Show Work	7%	21%	41%	33%	40%	32%
Short Explanation	13%	14%	66%	86%	93%	65%
Long Explanation	13%	43%	13%	33%	60%	34%
Creating/Posing Math Problems	0%	0%	3%	0%	0%	2%
Figural Patterns/Diagrams	0%	7%	13%	28%	7%	18%
Measuring	0%	0%	9%	6%	0%	7%
Modeling/Experiments	0%	21%	0%	0%	7%	5%
Oral	0%	0%	0%	6%	0%	5%
Other*	0%	7%	3%	9%	7%	9%

*Other: Journal, Categorizing/Ranking, and Cannot Determine

Relationship Between Classroom Activities and Questionnaire Responses for All Grades. The questionnaire asked teachers and students to indicate how often their classroom activities require explanations. Overall, 68% of the teachers indicated that they used activities requiring explanations on a daily (30%) or weekly (38%) basis. Whereas, 59% of the students indicated that they worked on such activities on a daily (23%) or weekly (26%) basis. More specifically, the questionnaire asked teachers to indicate how often they use multiple-choice, short answers, and written explanations on their classroom assessments. Approximately, 40% of the teachers indicated that they use assessment activities that require explanations weekly and 34% of the teachers indicated that they use assessments that require short answers this frequently, whereas small percentages of teachers indicated that they use multiple-choice formats either weekly (9%) or biweekly (14%). The results for the classroom assessment activities were fairly consistent with the questionnaire results, except 29% of the assessment activities were coded as including multiple-choice items.

Differences Across Grades. Table VIII.15 provides the overall percentages for each grade level which reflect the percentage of times each of the response types was coded for an activity regardless if one, two, three, four, five, or more response types were coded per activity. Differences across grades with respect to response type tended to occur more often for the assessment and test preparation activities than the instruction activities. In general, for the assessment and test preparation activities, the numerical value category was coded more often for the middle school grades as compared to the

elementary grades. This was most prominent for test preparation activities, in that, numerical value was coded for 85% of the 8th grade test preparation activities and 64% for the 3rd and 5th grade test preparation activities. There was a slightly higher tendency for elementary assessment activities, as compared to middle school assessment activities, to be coded for the multiple choice category. Whereas, there was a slightly higher tendency for the middle school assessment activities, as compared to the elementary assessment activities, to be coded for the show work category.

Several differences for the assessment activities can be observed for the on- (3rd and 5th) and off- (2nd and 4th) elementary grades. Assessment activities from the on-grades required more short explanations and to some extent, more long explanations as compared to the off-grades.

For the test preparation activities, making a table/chart/graph and creating figural patterns or diagrams as the final product occurred more often for 3rd grade as compared to the 5th and 8th grades. Whereas, long explanations occurred more often for the 8th grade test preparation activities (41%) as compared to the 3rd (23%) and 5th grades (32%).

Table VIII.15 Response Type for Mathematics Classroom Activities -- For Each Grade

Instruction	All grades	Grade 2nd	3rd	4th	5th	7th	8th
Multiple Choice/Matching	12%	13%	12%	15%	14%	7%	9%
Short Answer	29%	29%	28%	33%	31%	29%	25%
Numerical Value	74%	67%	66%	78%	77%	82%	80%
Expression	8%	7%	10%	5%	5%	8%	11%
Making a Chart/Table/Graph	24%	23%	26%	24%	30%	17%	21%
Show Work	15%	10%	18%	16%	13%	14%	20%
Short Explanation	27%	18%	28%	27%	31%	28%	29%
Long Explanation	10%	7%	9%	7%	10%	11%	14%
Creating/Posing Math Problems	5%	4%	7%	6%	6%	5%	2%
Figural Patterns/Diagrams	10%	11%	11%	10%	10%	6%	10%
Measuring	8%	7%	8%	5%	8%	10%	10%
Modeling/Experiments	3%	2%	2%	4%	3%	4%	4%
Oral	4%	6%	7%	5%	1%	3%	1%
Other*	4%	8%	3%	4%	4%	3%	2%
Assessment							
Multiple Choice/Matching	29%	33%	27%	38%	35%	22%	20%
Short Answer	31%	27%	27%	40%	32%	38%	29%
Numerical Value	73%	65%	73%	70%	65%	85%	77%
Expression	11%	7%	10%	5%	7%	19%	17%
Making a Chart/Table/Graph	18%	20%	19%	12%	22%	12%	21%
Show Work	22%	14%	21%	19%	15%	28%	33%
Short Explanation	23%	16%	37%	16%	25%	20%	21%
Long Explanation	9%	5%	7%	3%	8%	10%	18%
Creating/Posing Math Problems	3%	3%	3%	3%	3%	3%	1%
Figural Patterns/Diagrams	8%	7%	13%	6%	11%	5%	6%
Measuring	6%	8%	8%	6%	8%	5%	2%
Modeling/Experiments	1%	1%	1%	1%	2%	1%	1%
Oral	3%	6%	4%	2%	2%	2%	2%
Other*	3%	2%	7%	2%	3%	2%	1%
MSPAP Test Preparation							
Multiple Choice/Matching	6%	--	8%	--	11%	--	2%
Short Answer	38%	--	46%	--	29%	--	38%
Numerical Value	74%	--	64%	--	64%	--	85%
Expression	8%	--	3%	--	14%	--	9%
Making a Chart/Table/Graph	53%	--	64%	--	46%	--	48%
Show Work	32%	--	39%	--	29%	--	29%
Short Explanation	65%	--	69%	--	71%	--	59%
Long Explanation	34%	--	23%	--	32%	--	41%
Creating/Posing Math Problems	2%	--	0%	--	4%	--	3%
Figural Patterns/Diagrams	18%	--	31%	--	7%	--	14%
Measuring	7%	--	5%	--	4%	--	10%
Modeling/Experiments	5%	--	0%	--	8%	--	8%
Oral	5%	--	8%	--	.0%	--	5%
Other*	9%	--	13%	--	15%	--	3%

Relationship Between Classroom Activities and Questionnaire Responses Across Grades. These differences for the grade levels are somewhat consistent with the results from the questionnaire. Teachers and students were asked to indicate the extent to which their classroom activities required explanations and teachers were also asked to indicate the extent to which their assessments required written explanations. A larger percentage (52%) of 3rd and 5th grade teachers reported that on a weekly basis they use assessment activities that require written explanations, as compared to 2nd and 4th grade teachers (40%), 7th grade teachers (18%), and 8th grade teachers (27%). Also, larger percentages of 4th (28%) and 5th (32%) grade students indicated they work on assessments that ask them to explain in writing how they got their answer on a weekly basis, while only 11% of the 7th and 16% of the 8th grade students indicated this level of frequency. Further, a larger percentage of 3rd and 5th grade teachers reported that on a daily or weekly basis they use classroom activities that require students to explain (82%) as compared to 2nd and 4th (68%), 7th (58%) and 8th (50%) grade teachers.

Similarity to MSPAP Tasks

Each of the classroom instruction, assessment, and MSPAP test preparation activities were coded with respect to their similarity to MSPAP tasks. In particular, the process needed for solution, the type of responses required of students, and the format of the responses were considered in order to classify the activities according to one or more MSPAP-like levels. The first two levels include those activities that were considered "not at all like MSPAP": 1) computations, estimations, and equations, and 2) traditional textbook-like word problems. The first category reflects those problems that solely ask students to do a computation or estimation, or to solve an equation. The problems in the second category reflect traditional word problems in which students need to provide or select a numerical answer based on their computations. Thus, the first two categories do not require the same level of problem solving and/or reasoning as defined by the MLO's and MSPAP. Although some of the skills required in problems of these types may also be required by MSPAP tasks, overall the problems themselves are not considered to be similar to MSPAP tasks.

The other four levels include activities that are similar to MSPAP tasks to some extent: MSPAP-like 1, MSPAP-like 2, MSPAP-like 3, and MSPAP-like 4. Activities at the MSPAP-like 1 level only require students to develop or complete a graph, table, pattern, or to physically measure an object. In these types of activities, students are not required to provide any interpretation or explanation of their work, and the activity does not require the same level of problem solving and/or reasoning as defined by the MLO's and required by the MSPAP tasks.

MSPAP-like 2 activities require some problem solving and/or reasoning, but not to the same extent as required by MSPAP tasks. They also require students to show their work, provide an explanation, and/or interpret tables or graphs, and they can be completed in about five minutes.

MSPAP-like 3 and 4 activities require a similar level of problem solving and/or reasoning as required by the MSPAP tasks. MSPAP-like 3 tasks also require at least two short explanations or one long explanation (i.e., about a paragraph), and consist of about 3-5 items related to the same problem situation. Many of them also asked students to develop graphs, tables, or charts. MSPAP-like 3 tasks are considered to be similar to MSPAP tasks in terms of the processes being measured and the format, but not as extensive in length. MSPAP-like 4 tasks are considered to be similar to MSPAP tasks in terms of the processes being measured as well as the format in which they are measured. These tasks require students to show their work and/or to develop graphs, tables, or charts; they require at least 3 short explanations and/or one or more long explanations; and require students to respond to 6 or more items related to the same situation.

Each activity, regardless if it was one task or a set of distinct items, could be coded in more than one of the six MSPAP-like levels. For example, of the 1,940 instruction activities, 83% (1,617) were coded solely for one MSPAP-like level, 14% were coded for two MSPAP-like levels, and 2% were coded for three MSPAP-like levels. The other 1% were coded for four or more MSPAP-like levels. The test preparation activities were similar in this regard, about 89% were coded solely in one MSPAP-like level. A smaller percentage of assessment activities were coded in only one level (62%), and approximately 27% were coded in two levels, 9% in three levels, and 2% in four levels. It should be noted that for activities coded in two or more MSPAP-like levels, approximately 90% of the activities included at least one level that was "not at all like MSPAP".

All Grades. Table VIII.16 indicates the percentage of times an activity was coded for each MSPAP-like level when one, two, and three levels were coded per artifact. The last column in the table, labeled 'overall', indicates the percentage of times an activity was coded for each level regardless if one, two, or three levels were coded per activity. For example, for those instruction activities in which only one level was selected, computation/equation was selected for 39% of them; for those activities in which two levels were selected, computation/equation was selected for 79% of the tasks; and for those activities in which three levels were selected, computation/equation was selected for 98% of the tasks. Overall, regardless of how many MSPAP-like levels were coded for an activity, computation/equation was selected for 46% of the instruction activities.

As indicated in the table the most common type of instruction and assessment activity required the student to perform computations, to estimate, or to solve equations. This level was selected for 46% of the instruction activities and 66% of the assessment activities. In general, the MSPAP-like 2 was the

next most commonly coded level for the instruction (34%) and assessment (32%) activities and then, traditional word problems (14% for instruction and 31% for assessment activities). The MSPAP-like 4 level was one of the least frequently coded categories for instruction (5%) and assessment (4%) activities.

As might be expected, the 3rd, 5th, and 8th grade MSPAP test preparation activities, as compared to the instruction and assessment activities, are more similar to MSPAP tasks as indicated by the 'overall' column. The most frequently coded levels for the test preparation activities were MSPAP-like 2 (38%) and MSPAP-like 4 (37%) task types. The next most frequently coded task type for test preparation activities was the MSPAP-like 3 task type (27%). The computation/equation level was selected for only 15% of the MSPAP test preparation activities. Similar tables for each of the grades are provided in Appendix E.

Table VIII.16 MSPAP-like Levels for Mathematics Classroom Activities - All Grades

	Number of Levels Selected			Overall
	One	Two	Three	
Instruction	n=1617 (83%)	n=278 (14%)	n=41 (2%)	
Not at all like MSPAP				
Computation/Equation	39%	79%	98%	46%
Traditional Word Problems	6%	49%	73%	14%
MSPAP-like Levels				
MSPAP-like 1	10%	19%	37%	12%
MSPAP-like 2	31%	45%	88%	34%
MSPAP-like 3	9%	7%	2%	9%
MSPAP-like 4	5%	<1%	2%	5%
Assessment	n=857(62%)	n=388(27%)	n=129(9%)	overall
Not at all like MSPAP				
Computation/Equation	49%	91%	98%	66%
Traditional Word Problems	4%	67%	92%	31%
MSPAP-like Levels				
MSPAP-like 1	6%	13%	24%	12%
MSPAP-like 2	27%	26%	83%	33%
MSPAP-like 3	9%	3%	2%	6%
MSPAP-like 4	6%	0%	0%	4%
MSPAP Test Preparation	n=115 (92%)	n=7 (6%)	n=2 (2%)	overall
Not at all like MSPAP				
Computation/Equation	9%	100%	50%	15%
Traditional Word Problems	0%	14%	50%	2%
MSPAP-like Levels				
MSPAP-like 1	3 %	0%	50%	4%
MSPAP-like 2	33%	86%	100%	38%
MSPAP-like 3	23%	0 %	50%	27%
MSPAP-like 4	32%	0 %	0%	37%

Relationship Between Classroom Activities and Questionnaire Responses for All Grades. On the questionnaires, teachers and 4th, 5th, 7th, and 8th students were asked to indicated how often students have the opportunity to solve tasks similar to those on MSPAP. Overall, 31% of the teachers indicated that students have the opportunity weekly or daily, 47% indicated biweekly or monthly, 21% indicated about 4 times per year, and 2% said never. Overall, 38% of the students indicated that they solve such tasks weekly or daily, 33% indicated biweekly or monthly, 22% indicated about 4 times per year, and 7% said never. The analysis of the classroom instruction materials indicated that for those activities in which only one MSPAP-like level was coded, 55% of them were coded as being on the MSPAP scale ranging from MSPAP-like 1 to MSPAP-like 4. On the other hand, only 14% received the two highest levels (MSPAP-like 3 and MSPAP-like 4). These results indicate that over 50% of the

instruction activities required problem solving and/or reasoning as defined by the MLO's to some extent. A smaller percentage of the activities, however, were as extensive as the MSPAP tasks and required the same level of problem solving.

Teachers and students were asked to indicate on their questionnaires the extent to which they use open-ended problems and extended activities for both instruction and assessment. The majority of the classroom instruction and assessment activities that were coded MSPAP-like 1, MSPAP-like 2, and MSPAP-like 3 could be classified as open-ended problems, whereas activities that were coded as MSPAP-like 4 could be classified as open-ended problems that require an extended period of time to complete. Approximately 50% of the instruction activities and 42% of the assessment activities received codes ranging from MSPAP-like 1 to MSPAP-like 3, and 5% of the instruction activities and 6% of the assessment activities were coded as MSPAP-like 4. Overall, 59% of the teachers indicated that students have the opportunity daily or weekly to work on open-ended problems for instruction and 25% indicated this level of frequency for assessment. In addition, 18% of the teachers indicated that students have the opportunity daily or weekly to work on extended problems for instruction and 8% indicated this level of frequency for assessment. In general, the results from the classroom activities are fairly consistent with the teacher questionnaire results, in particular, with respect to the assessment activities.

The percentages of students who indicated that they had the opportunity to work on open-ended problems tended to be higher than the teacher percentages. Overall, 77% of the students indicated that they had the opportunity to work on open-ended problems for instruction on a daily or weekly basis and 57% indicated this level of frequency for assessment. Also, 18% of the students indicated that they had the opportunity to work on extended problems for instruction on a daily or weekly basis and 3% indicated this level of frequency for assessment.

Differences Across Grades. In Table VIII.17, the overall results for each grade level are provided. The overall percentages in the table reflect the percentage of times each MSPAP-like level was coded for an activity regardless of the number of codes per activity. Differences across grades were rather small. For instruction, slightly more elementary activities were coded as MSPAP-like 1 and slightly more middle school activities were coded as MSPAP-like 3 activities. Also, for instruction and assessment activities, there was a slight increase in the percentage of MSPAP-like 3 and MSPAP-like 4 activities for the on-grade levels when compared to the off-grade levels. As an example, the percentage of MSPAP-like 3 and 4 instruction activities for the on-grades (3rd, 5th, and 8th) range from 14% to 20% depending on grade, whereas the percentages for the off-grades range from 8% to 13%.

With regard to MSPAP test preparation, 58% of the 5th grade activities were coded as MSPAP-like 2, whereas only 33% of the 3rd and 8th grade activities were coded at this level. More activities in the

3rd and 8th grades (57% and 53%) were coded as either MSPAP-like 3 or MSPAP-like 4 compared to a smaller percentage of activities in the 5th grade (40%).

Relationship Between Classroom Activities and Questionnaire Responses Across Grades. The results from the questionnaires are somewhat consistent in that 3rd and 5th grade teachers indicated that they use tasks similar to those on MSPAP most frequently and 7th grade teachers indicated that they use them the least frequently. Also, a smaller percentage of 4th and 7th grade students (35% and 31%, respectively) reported that they worked on MSPAP-like tasks daily or weekly when compared to the 5th and 8th grade students (44% and 40%, respectively).

Table VIII.17 MSPAP-like Levels for Mathematics Classroom Activities -- For Each Grade

Instruction	All grades	Grade					
		2nd	3rd	4th	5th	7th	8th
Not at all like MSPAP							
Computation/Equation	46%	51%	44%	50%	41%	45%	46%
Traditional Word Problems	14%	6%	12%	17%	17%	15%	17%
MSPAP-like Levels							
MSPAP-like 1	12%	17%	12%	11%	15%	6%	9%
MSPAP-like 2	34%	28%	35%	38%	38%	36%	30%
MSPAP-like 3	9%	5%	8%	8%	8%	11%	13%
MSPAP-like 4	5%	3%	6%	1%	7%	2%	7%
Assessment							
Not at all like MSPAP							
Computation/Equation	66%	64%	54%	72%	62%	79%	67%
Traditional Word Problems	31%	34%	26%	38%	35%	34%	23%
MSPAP-like Levels							
MSPAP-like 1	12%	16%	10%	12%	12%	9%	11%
MSPAP-like 2	32%	31%	40%	31%	35%	34%	24%
MSPAP-like 3	6%	4%	8%	3%	6%	5%	11%
MSPAP-like 4	4%	1%	5%	1%	7%	2%	4%
MSPAP Test Preparation							
Not at all like MSPAP							
Computation/Equation	15%	--	10%	--	11%	--	21%
Traditional Word Problems	2%	--	3%	--	4%	--	2%
MSPAP-like Levels							
MSPAP-like 1	4%	--	5%	--	4%	--	3%
MSPAP-like 2	38%	--	33%	--	58%	--	33%
MSPAP-like 3	27%	--	26%	--	11%	--	24%
MSPAP-like 4	37%	--	31%	--	29%	--	29%

Nature of Activities Within Each MSPAP-like Level. To provide more information about the nature of the activities in each of the six MSPAP-like levels, the instruction and assessment activities that were coded in only one level were analyzed with respect to format, process outcomes, content outcomes,

interpretation of graphs, integration, manipulatives, and response type. Of the 1,940 instruction activities, 1,617 received only one code for MSPAP-like level; and of the 1,388 assessment activities, 857 received only one code. The results are reported for the grades combined.

Activity Format. Nearly all of the computation/equation and traditional word problem activities were coded as containing several distinct items. Whereas, all of the MSPAP-like 3 and MSPAP-like 4 activities and over 90% of the MSPAP-like 2 activities were coded as being one task with several items related to the same problem situation.

Maryland Learning Process Outcomes. As defined by the coding scheme, none of the computation/equation or traditional word problem instruction and assessment activity types were coded for problem solving and/or reasoning, about half of the MSPAP-like 1 activities were coded for problem solving and/or reasoning, and all MSPAP-like 2 through 4 activities were coded for problem solving and/or reasoning. It is important to note that the extent to which problem solving and/or reasoning was reflected in the activities increased as the level of the MSPAP-like activities increases.

Maryland Learning Content Outcomes. As indicated in Table VIII.18, the most frequently coded content outcome for the computation/equation, traditional word problem, MSPAP-like 2, and MSPAP-like 3 instruction and assessment activity types was numbers and operations. However, for the MSPAP-like 2 and MSPAP-like 3 activities, as compared to the other two more traditional activity levels, other content activities were coded more frequently, such as geometry/measurement and statistics. Moreover, statistics was coded more frequently than the other content areas for MSPAP-like 4 activities, with numbers and operations and geometry/measurement being the next most frequently coded content outcomes.

Table VIII.18 Content Learning Content Outcomes for MSPAP-like Levels

	Not at all like MSPAP		MSPAP-like Levels			
	Computation or Equation	Traditional Word Problems	MSPAP - like 1	MSPAP -like 2	MSPAP -like 3	MSPAP - like 4
Instruction	n=627	n=99	n=154	n=494	n=149	n=85
Numbers and Operations	70%	90%	12%	55%	41%	47%
Geometry/ Measurement	21%	16%	44%	20%	34%	44%
Statistics	2%	5%	38%	27%	39%	49%
Probability	3%	5%	2%	12%	14%	19%
Patterns and Relationships	1%	0%	15%	4%	6%	4%
Prealgebra	4%	0%	0%	<1%	1%	0%
Functions and Algebra	8%	18%	0%	3%	2%	2%
None	0%	0%	0%	0%	0%	0%
Assessment	n=416	n=33	n=55	n=215	n=74	n=50
Numbers and Operations	71%	85%	11%	58%	49%	36%
Geometry/Measurement	22%	12%	40%	21%	30%	40%
Statistics	2%	0%	38%	28%	38%	60%
Probability	2%	0%	2%	8%	10%	14%
Patterns and Relationships	1%	6%	13%	5%	4%	4%
Prealgebra	9%	3%	0%	1%	0%	0%
Functions and Algebra	16%	15%	2%	3%	4%	8%
None	0%	0%	4%	0%	0%	0%

Interpretation of Graphs, Tables or Charts. The interpretation of graphs, tables, or charts was rare for instruction and assessment activities coded as either computation/equation or traditional word problems (between 4% and 12%). Whereas, the interpretation of graphs, tables or charts became more prevalent as the level of the MSPAP-like activities increased as indicated in Table VIII.19. As an example, consider the instruction activities. Approximately 44% of the MSPAP-like 2 activities, 69% of the MSPAP-like 3 activities, and 85% of the MSPAP like 4 activities required interpretation of graphs, tables or charts.

Table VIII.19 Interpreting Graphs, Tables, or Charts for MSPAP-like Levels

	Not at all like MSPAP		MSPAP-like Levels			
	Computation or Equation	Traditional Word Problems	MSPAP -like 1	MSPAP -like 2	MSPAP -like 3	MSPAP - like 4
Instruction	n=627	n=99	n=154	n=494	n=149	n=85
Yes	5%	7%	8%	44%	69%	85%
No	95%	93%	92%	56%	31%	15%
Assessment	n=416	n=33	n=55	n=215	n=74	n=50
Yes	4%	12%	16%	47%	66%	78%
No	96%	88%	84%	54%	34%	22%

Integration with Other Subject Areas. In general, as the level of the MSPAP-like activities increases, the percentage of the tasks that were integrated with another subject area also increases as indicated in Table VIII.20. For example, integration was prevalent for only 1% of the computation/equation instruction activities, 16% of the MSPAP-like 2 instruction activities, and 60% for the MSPAP-like 3 instruction activities.

Table VIII.20 Integration of Other Subject Areas for MSPAP-like Levels

	Not at all like MSPAP		MSPAP-like Levels			
	Computation or Equation	Traditional Word Problems	MSPAP -like 1	MSPAP -like 2	MSPAP -like 3	MSPAP - like 4
Instruction	n=627	n=99	n=154	n=494	n=149	n=85
Science	<1%	2%	1%	3%	9%	21%
Social Studies	1%	1%	2%	1%	2%	3%
Reading Materials	1%	0%	1%	3%	1%	2%
Writing Letters/Persuasive Paragraphs, etc.	0%	0%	0%	5%	14%	33%
Language Usage	0%	0%	0%	1%	1%	0%
Art	0%	0%	1%	1%	3%	2%
Glyphs/Tesselations	0%	0%	12%	3%	1%	0%
No Integration	99%	97%	83%	84%	69%	40%
Assessment	n=416	n=33	n=55	n=215	n=74	n=50
Science	<1%	0%	4%	3%	4%	13%
Social Studies	0%	0%	2%	2%	3%	0%
Reading Materials	1%	0%	0%	1%	1%	0%
Writing Letters/Persuasive Paragraphs, etc.	0%	0%	0%	6%	20%	40%
Language Usage	0%	0%	0%	1%	0%	0%
Art	<1%	0%	2%	2%	0%	0%
Glyphs/Tesselations	0%	0%	8%	2%	3%	0%
No Integration	99%	100%	85%	84%	68%	48%

Use of Manipulatives, Calculators, and Computers. In general, as the level of the MSPAP-like activities increases, the use of manipulatives and calculators increases as indicated in Table VIII.21. For example, the use of manipulatives was prevalent for 16% of the computation/equation instruction activities, 31% of the MSPAP-like 2 instruction activities, and 49% for the MSPAP-like 4 instruction activities.

Table VIII.21 Manipulatives, Calculators, and Computers for MSPAP-like Levels

	Not at all like MSPAP		MSPAP-like Levels			
	Computation or Equation	Traditional Word Problems	MSPAP -like 1	MSPAP -like 2	MSPAP -like 3	MSPAP - like 4
Instruction	n=627	n=99	n=154	n=494	n=149	n=85
Manipulatives	3%	1%	2%	31%	42%	49%
Calculators	8%	7%	12%	2%	4%	15%
Computers	2%	1%	3%	<1%	1%	1%
None	87%	91%	81%	66%	53%	34%
Assessment	n=416	n=33	n=55	n=215	n=74	n=50
Manipulatives	3%	0%	6%	19%	23%	30%
Calculators	4%	6%	15%	3%	10%	7%
Computers	1%	0%	4%	1%	0%	2%
None	92%	94%	76%	77%	68%	61%

Response Type Required of Student. In general, the most frequently coded response types across the MSPAP-like levels differed for activities that were not similar to MSPAP tasks and for those that were similar as shown in Table VIII.22. For example, the most frequently coded response types for computation/equation instruction activities were numerical value (78%), short answer (24%), multiple-choice (15%), and show work (10%). The most frequently coded response types for MSPAP-like 2 and MSPAP-like 3 activities were numerical value (67% and 71%), short explanation (43% and 73%), making a chart, graph, or table (31% and 56%), and short answer (33% and 42%), with the latter three response types being more prevalent for MSPAP-like 3 activities. The most frequently coded response types for MSPAP-4 activities were short explanation (92%), numerical value (81%), making a chart, graph, or table (72%), and long explanations (61%). It is important to note that as the level of MSPAP-like activities increases, more response types were coded for a given activity and the response types were more similar to the response types on MSPAP tasks.

Table VIII.22 Response Type for MSPAP-like Levels

	Not at all like MSPAP		MSPAP-like Levels			
	Computation or Equation	Traditional Word Problems	MSPAP -like 1	MSPAP -like 2	MSPAP -like 3	MSPAP - like 4
Instruction	n=627	n=99	n=154	n=494	n=149	n=85
Multiple Choice/Matching	15%	16%	3%	6%	4%	5%
Short Answer	24%	8%	14%	33%	42%	42%
Numerical Value	78%	85%	42%	67%	71%	81%
Expressions	7%	7%	3%	6%	9%	13%
Making a Chart/Table/Graph	2%	1%	49%	31%	56%	72%
Show Work	10%	25%	3%	16%	25%	35%
Short Explanation	2%	1%	1%	43%	73%	92%
Long Explanation	0%	1%	1%	11%	38%	61%
Creating Math Problems	1%	3%	3%	1%	3%	4%
Figural Patterns/Diagrams	9%	0%	21%	7%	12%	9%
Measuring	1%	0%	25%	5%	13%	25%
Modeling/Expressions	0%	0%	8%	2%	9%	19%
Oral	4%	0%	1%	6%	5%	7%
Other	3%	1%	1%	5%	5%	8%
Assessment	n=416	n=33	n=55	n=215	n=74	n=50
Multiple Choice/Matching	23%	15%	6%	8%	5%	8%
Short Answer	26%	30%	15%	25%	42%	56%
Numerical Value	82%	85%	40%	61%	74%	90%
Expressions	11%	6%	0%	7%	8%	30%
Making a Chart/Table/Graph	2%	9%	55%	33%	45%	80%
Show Work	17%	15%	9%	24%	38%	38%
Short Explanation	2%	3%	0%	49%	66%	96%
Long Explanation	0%	0%	0%	14%	55%	62%
Creating Math Problems	<1%	0%	2%	7%	3%	4%
Figural Patterns/Diagrams	5%	0%	6%	9%	23%	16%
Measuring	1%	0%	26%	3%	11%	6%
Modeling/Expressions	1%	0%	7%	2%	3%	8%
Oral	5%	3%	2%	3%	7%	6%
Other	1%	3%	4%	8%	4%	12%

The scoring schemes were coded according to the type of scoring scheme (e.g., letter/numerical grades, checklist, point system, scale levels); whether the scoring scheme was specific to an activity or a more general scheme that applied to a variety of activities; the components of the response that were being evaluated, and the evaluator of student performance. As mentioned previously, a total of 332 scoring schemes were coded with the majority of them being teacher developed (35%), county developed (20%), or commercially developed (15%).

Scoring Scheme Type

The scoring schemes were coded as to whether they reflected the use of letter/numerical grades (e.g., 90-100%, 89-90%, etc.), checklists, point systems, scale levels, or a qualitative written explanation. If a scoring scheme was a point system, it was coded as to whether dimensions were specified. A point system without dimensions specified a certain number of points for correct answers to the activity, whereas a point system with dimensions indicated the number of points to be assigned to each part of the response, for example two points for the numerical answer and three points for the explanation. Scoring schemes that were coded as having scale levels were used to evaluate the response to an activity holistically, that is, one overall score was assigned to the entire response. When a scoring scheme was classified as consisting of scale levels, it was coded according to the number of scale levels (only 2 levels or more than 2 levels) and to the type of criteria for each level (no/low-level criteria or high-level criteria). Low-level criteria were defined as focusing primarily on the inclusion or omission of the answer, explanation, or graph without evaluating the quality of the response. High-level criteria were defined as focusing primarily on the quality of the response (i.e., explanation or graph). Qualitative written explanations reflect scoring schemes that provided only a written evaluation of the response without providing any quantitative score.

Table VIII.23 shows that over half of the scoring schemes across all grades (58%) were coded as consisting of more than 2 scale levels with either high or low criteria, 15% were point systems with dimensions, 9% were letter/numerical grades, 8% were point systems without dimensions, and 7% were checklists. Within some of the scoring scheme types, there were differences across grades. For instance, a larger percentage of scoring schemes in the 2nd and 4th grades (off-grades) compared to the other grade levels were coded as letter/numerical grades. Whereas, a larger percentage of scoring schemes in the 3rd and 5th grades (on-grades) compared to the other grades were coded as more than 2 scale levels with high-level criteria. Lastly, the 7th and 8th grades contained a higher percentage of point systems with dimensions than the elementary grades.

Table VIII.23 Scoring Schemes Used in Mathematics Classroom Activities

	All Grades	2nd	3rd	4th	5th	7th	8th
Letter/ Numerical grades	9%	32%	4%	16%	7%	5%	4%
Checklist	7%	6%	8%	19%	8%	6%	0%
Point System - No Dimensions	8%	0%	4%	13%	8%	6%	17%
Point System - With Dimensions	15%	6%	4%	0%	10%	28%	30%
Only 2 Scale Levels	1%	3%	1%	0%	2%	0%	0%
More than 2 Scale Levels (no or low-level criteria)	8%	6%	11%	0%	7%	10%	9%
More than 2 Scale Levels (high-level criteria)	50%	44%	68%	44%	57%	44%	36%
Qualitative Written Explanation	2%	0%	0%	3%	2%	2%	3%
Cannot Determine	1%	3%	0%	6%	0%	0%	2%

General versus Specific Scoring Schemes

Scoring schemes were classified according to whether they pertained to only one specific activity or if they were applicable to more than one activity. Across all grades, Table VIII.24 indicates that 61% of the scoring schemes were specific to an activity, and the other 39% were general. Differences occurred in the percentages for 4th and 7th grade compared to the other grade levels. For the 2nd, 3rd, 5th, and 8th grades the majority of the scoring schemes were for a specific task, whereas in 4th grade the reverse was true, and in 7th grade there was an equal percentage of specific and general scoring schemes.

Table VIII.24 General versus Specific Scoring Schemes

	All Grades	2nd	3rd	4th	5th	7th	8th
Scoring scheme for a specific activity	61%	71%	67%	34%	69%	50%	67%
General scoring scheme	39%	30%	31%	66%	32%	50%	33%

Evaluation Components

All Grades. The scoring schemes that specified either dimensions or scale levels with criteria were analyzed according to the type of components that were reflected in the evaluation criteria. In addition to mathematics knowledge, Table VIII.25 indicates other evaluation components that were coded for those scoring schemes that explicitly specified evaluation criteria. One or more evaluation components could have been coded for a given scoring scheme. Besides mathematics knowledge which was embedded in these scoring schemes, the most frequently coded evaluation component was communication in writing

and/or explanations (63%). The next most frequently coded evaluation components were solution strategies/work (34%), graphs, tables, or charts (33%), and language usage (26%).

Table VIII.25 Evaluation Components in Scoring Schemes - All Grades

	Number of Evaluation Components Selected					Overal l
	One or None	Two	Three	Four	Five	
	n=61 (18%)	n=67 (20%)	n=110 (33%)	n=70 (21%)	n=22 (7%)	
Communication in Writing/Explanation	0%	49%	81%	93%	100%	63%
Language Usage	0%	6%	24%	53%	77%	26%
Solution Strategies/Show Work	0%	30%	40%	51%	59%	34%
Graphs/Tables/Charts, etc.	3%	24%	31%	59%	73%	33%
Examples	0%	0%	8%	17%	18%	8%
Oral	0%	2%	2%	1%	14%	3%
Appearance/Neatness	0%	3%	16%	21%	50%	14%
Group Skills	2%	2%	2%	6%	9%	3%
Attitudes	3%	0%	0%	0%	0%	1%

Differences Across Grades. Scoring schemes in the middle grades as well as the elementary on-grades (3rd and 5th), as compared to the elementary off-grades (2nd and 4th), were more likely to include written explanations as an evaluation component as shown in Table VIII.26. For example, consider the two extremes: 73% of the 3rd grade scoring schemes were coded for communication in writing/explanations, whereas only 44% of the 4th grade scoring schemes were so coded. Another difference across grades was the evaluation of graphs, tables, and charts. As the grade level increased, the percentage of scoring schemes that included this evaluation component increased. For example, 18% in 2nd grade compared to 44% in 8th grade.

Table VIII.26 Evaluation Components in Scoring Schemes -- For Each Grade

	All grades	Grade					
		2nd	3rd	4th	5th	7th	8th
Communication in Writing/Explanation	63%	47%	73%	44%	62%	70%	64%
Language Usage	26%	15%	31%	16%	31%	36%	17%
Solution Strategies/Show Work	34%	27%	29%	47%	28%	41%	38%
Graphs/Tables/Charts, etc.	33%	18%	24%	25%	36%	42%	44%
Examples	8%	9%	0%	3%	10%	11%	14%
Oral	3%	3%	4%	0%	2%	3%	3%
Appearance/Neatness	14%	6%	9%	19%	12%	22%	17%
Group Skills	3%	3%	1%	9%	0%	6%	3%
Attitudes	1%	0%	1%	3%	0%	0%	0%
Not Applicable	11%	27%	4%	22%	18%	8%	5%

Evaluator of Student Performance

The scoring schemes were also coded according to the person(s) applying the scheme to the student responses, either the teacher, the student, peers, or some combination. As shown in Table VIII.27, across grade levels the teachers most often were the evaluators (91%), then the student (4%), a combination of teacher and student and/or peers (3%), and peers (2%). The results across grades were similar.

Table VIII.27 Scoring Evaluator of Mathematics Classroom Activities

	All Grades	2nd	3rd	4th	5th	7th	8th
Teacher	91%	94%	96%	91%	93%	83%	91%
Student/Self	4%	3%	4%	9%	3%	5%	3%
Peer	2%	0%	0%	0%	2%	2%	5%
Teacher and Student and/or Peer	3%	3%	0%	0%	2%	11%	2%

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Appendix A

Sample for Classroom Activities by Grade Level

	Activities		Teachers		Mean Number of Activities Per Teacher
	Number	Percentage	Number	Percentage	
Instruction					
Grade 2	308	16%	37	15%	8.32
Grade 3	423	22%	49	20%	8.63
Grade 4	245	13%	31	13%	7.90
Grade 5	328	17%	44	18%	7.45
Grade 7	315	16%	37	15%	8.51
Grade 8	321	17%	50	20%	6.42
Assessment					
Grade 2	225	16%	36	17%	6.25
Grade 3	287	21%	40	19%	7.18
Grade 4	162	12%	26	12%	6.23
Grade 5	246	18%	38	18%	6.47
Grade 7	233	17%	32	15%	7.28
Grade 8	235	17%	43	20%	5.47
Test Preparation					
Grade 3	39	31%	21	41%	1.86
Grade 5	28	22%	10	20%	2.80
Grade 8	58	46%	20	39%	2.90
Scoring Scheme					
Grade 2	34	10%	17	12%	2.00
Grade 3	75	23%	29	20%	2.59
Grade 4	32	10%	14	10%	2.29
Grade 5	61	18%	27	19%	2.26
Grade 7	64	19%	23	16%	2.78
Grade 8	66	20%	32	23%	2.06
Not Coded					
Grade 2	24	15%	15	17%	1.60
Grade 3	30	18%	16	18%	1.88
Grade 4	15	9%	9	10%	1.67
Grade 5	35	21%	17	19%	2.06
Grade 7	27	17%	13	14%	2.08
Grade 8	32	20%	20	22%	1.60

Appendix B

Adjustment for Calculating Rate of Agreement for Classroom Activities Coding

To obtain the correction for the total number of possible agreements, three sources of information were used:

1) Within each item (e.g., #14 Problem/Item Type), the percentage of times each option was coded was obtained (e.g., computation, textbook-like, etc.).

   For example, 1830 out of 3482 or 53% of the activities had the "computations" option coded for the problem/item type.

2) For each item, the frequency distribution for the number of total options selected for an activity was obtained.

   For example, for problem/item type, 75% of the activities had only 1 option selected, 19% of the activities had 2 options selected, and 5% of the activities had 3 options selected.

3) Rater's knowledge of the coding scheme and the nature of the activities was used to determine the number of possible options that would need to be considered when selecting an option within an item.

   For example, for problem/item type, if an artifact involves primarily graphing, then a rater may have to consider 2 options (MSPAP-like 1 and MSPAP-like 2) when making a decision.

To determine an appropriate number used for adjusting the total possible agreements, each item in which a rater could choose more than one option was considered. These items are 11, 13, 14, 15, 16, 20, and 23. The steps used to obtain the adjustment are as follows. Once again, Problem/Item Type is used as an illustration.

1) The frequency distribution for the number of options selected per activity was examined. For the item, Problem/Item Type, there were some instances in which more than one option was selected for an artifact. While only 1 option was selected in 75% of the activities, 2 options were coded for 19% of the activities, and 3 options were coded for 5% of the activities. To obtain a very conservative estimate of agreement, it could be said that up to 2 options were considered for nearly all activities (except 5% of them). Therefore, since a total of 7 options are in this category, then 5 options were not considered in the decision-making for each activity. So the adjustment would be by 5.

2) The information used next was the percentages of times each option was selected. For Problem/Item Type, 4 options were selected more than 10% of the time. They were: computation, textbook-like word problems, MSPAP-like 1, and MSPAP-like 2. To obtain a more liberal estimate of agreement, it could be said that 4 options were considered when coding each artifact in this category. There are a total of 7 options in this category, therefore the adjustment would be by 3 (the number of options that were not considered in the decision-making process).

3) Using both pieces of information above, the options in this category were discussed qualitatively by the raters to determine what combinations of options needed to be considered when making various decisions related to coding the activities. For those activities with 2 codes, it is possible that the rater

had to consider 2 options for each of the codes prior to selecting each of the 2 codes. Therefore, a total of 4 options may have been considered for each activity. For example, one portion of the activity may consist of a task that could be coded as either MSPAP-like 1 or MSPAP-like 2. Another portion of the activity could consist of items that could be considered as either computation or textbook-like word problems.

Once again, this leads to an adjustment equal to 3 (7 total options minus 4 options being considered.) However, in this category, the percentage of times that a total of 2 options was coded for an activity (19%) was considerably less than the percentage of times only 1 option was coded (75%). Therefore, taking this information into account with the very conservative estimate of 5 (described in step 1 above), the adjustment for the problem/item type category was determined to be 4.

Example:

When 2 options are coded (and only those 2 are considered) adjust by 5:

1	0	0%	
1	1	100%	very conservative estimate of 50%

When 2 options are coded (and 4 options are considered) adjust by 3:

0	0	100%	
1	1	100%	
0	1	0%	
0	0	100%	liberal estimate of 75%

We select somewhere between these two estimates of 50% and 75% (adjust by 4).

Appendix C

Content Learning Outcomes for Mathematics Classroom Activities -- Grade 2

	Number Of Learning Outcomes Selected			overall
	One	Two	Three	
Instruction	n=261 (85%)	n=40 (13%)	n=6 (2%)	
Numbers and Operations	65%	58%	83%	65%
Geometry/ Measurement	13%	63%	100%	22%
Statistics	11%	53%	67%	18%
Probability	5%	10%	17%	6%
Pattern and Relationships	4%	18%	33%	7%
Pre-Algebra	0%	0%	0%	0%
Algebra	0%	0%	0%	0%
None	1%	0%	0%	1%
Assessment	n=167 (74%)	n=42 (19%)	n=16 (7%)	
Numbers and Operations	72%	88%	100%	77%
Geometry/ Measurement	13%	47%	75%	24%
Statistics	10%	33%	50%	17%
Probability	2%	5%	19%	4%
Pattern and Relationships	2%	21%	56%	10%
Pre-Algebra	0%	0%	0%	0%
Algebra	0%	5%	0%	1%
None	<1%	0%	0%	<1%

	Number Of Learning Outcomes Selected			overall
	One	Two	Three	
Instruction	n=356 (84%)	n=52 (12%)	n=12 (3%)	
Numbers and Operations	60%	79%	92%	63%
Geometry/ Measurement	19%	62%	100%	27%
Statistics	14%	31%	67%	18%
Probability	5%	21%	8%	8%
Pattern and Relationships	2%	8%	33%	4%
Pre-Algebra	0%	0%	0%	0%
Algebra	0%	0%	0%	0%
None	<1%	0%	0%	<1%
Assessment	n=210 (73%)	n=58 (20%)	n=14 (5%)	
Numbers and Operations	62%	83%	100%	69%
Geometry/ Measurement	19%	55%	71%	30%
Statistics	14%	33%	64%	22%
Probability	2%	9%	14%	5%
Pattern and Relationships	2%	21%	50%	9%
Pre-Algebra	1%	0%	0%	<1%
Algebra	0%	0%	0%	<1%
None	1%	0%	0%	1%
Test Preparation	n=23 (59%)	n=9 (23%)	n=7 (18%)	
Numbers and Operations	57%	56%	71%	59%
Geometry/ Measurement	26%	67%	100%	49%
Statistics	9%	33%	71%	26%
Probability	4%	11%	0%	5%
Pattern and Relationships	4%	33%	57%	21%
Pre-Algebra	0%	0%	0%	0%
Algebra	0%	0%	0%	0%
None	0%	0%	0%	0%

	Number Of Learning Outcomes Selected			overall
	One	Two	Three	
Instruction	n=201 (82%)	n=38 (16%)	n=2 (1%)	
Numbers and Operations	62%	84%	100%	66%
Geometry/ Measurement	22%	40%	50%	26%
Statistics	10%	29%	50%	15%
Probability	3%	21%	50%	7%
Pattern and Relationships	3%	24%	50%	7%
Pre-Algebra	0%	0%	0%	<1%
Algebra	0%	3%	0%	1%
None	1%	0%	0%	<1%
Assessment	n=122 (75%)	n=32 (20%)	n=7 (4%)	
Numbers and Operations	71%	91%	86%	76%
Geometry/ Measurement	21%	63%	71%	32%
Statistics	5%	34%	57%	14%
Probability	1%	6%	14%	3%
Pattern and Relationships	2%	3%	57%	4%
Pre-Algebra	0%	0%	0%	0%
Algebra	0%	3%	14%	1%
None	1%	0%	0%	1%

Content Learning Outcomes for Mathematics Classroom Activities -- Grade 5

	Number Of Learning Outcomes Selected			overall
	One	Two	Three	
Instruction	n=257 (78%)	n=56 (17%)	n=8 (2%)	
Numbers and Operations	52%	77%	100%	58%
Geometry/ Measurement	22%	54%	88%	30%
Statistics	20%	36%	25%	24%
Probability	4%	18%	63%	9%
Pattern and Relationships	2%	9%	25%	5%
Pre-Algebra	<1%	4%	0%	1%
Algebra	0%	4%	0%	1%
None	0%	0%	0%	0%
Assessment	n=152 (62%)	n=62 (25%)	n=25 (10%)	
Numbers and Operations	55%	89%	88%	68%
Geometry/ Measurement	24%	57%	80%	40%
Statistics	15%	36%	48%	25%
Probability	3%	5%	40%	9%
Pattern and Relationships	2%	8%	28%	8%
Pre-Algebra	0%	3%	4%	1%
Algebra	0%	3%	12%	2%
None	2%	0%	0%	2%
Test Preparation	n=16 (57%)	n=7 (25%)	n=3 (11%)	
Numbers and Operations	31%	86%	67%	54%
Geometry/ Measurement	19%	57%	100%	43%
Statistics	31%	29%	33%	32%
Probability	13%	29%	67%	21%
Pattern and Relationships	0%	0%	33%	11%
Pre-Algebra	0%	0%	0%	7%
Algebra	0%	0%	0%	0%
None	6%	0%	0%	4%

	Number Of Learning Outcomes Selected			overall
	One	Two	Three	
Instruction	n=230 (73%)	n=75 (24%)	n=8 (3%)	
Numbers and Operations	45%	79%	88%	54%
Geometry/ Measurement	26%	29%	63%	28%
Statistics	12%	33%	50%	18%
Probability	8%	11%	13%	9%
Pattern and Relationships	1%	3%	13%	2%
Pre-Algebra	2%	7%	25%	4%
Algebra	6%	39%	50%	16%
None	<1%	0%	0%	<1%
Assessment	n=121 (52%)	n=63 (27%)	n=34 (15%)	
Numbers and Operations	50%	79%	100%	68%
Geometry/ Measurement	25%	24%	38%	29%
Statistics	10%	14%	15%	17%
Probability	8%	2%	3%	5%
Pattern and Relationships	0%	6%	0%	4%
Pre-Algebra	2%	16%	50%	17%
Algebra	4%	59%	94%	37%
None	2%	0%	0%	1%

	Number Of Learning Outcomes Selected			overall
	One	Two	Three	
Instruction	n=245 (76%)	n=59 (18%)	n=13 (4%)	
Numbers and Operations	36%	68%	92%	45%
Geometry/ Measurement	25%	48%	39%	31%
Statistics	17%	25%	15%	19%
Probability	3%	12%	8%	5%
Pattern and Relationships	2%	7%	15%	4%
Pre-Algebra	5%	9%	39%	7%
Algebra	11%	32%	92%	19%
None	1%	0%	0%	1%
Assessment	n=144 (61%)	n=60 (26%)	n=21 (9%)	
Numbers and Operations	38%	57%	95%	50%
Geometry/ Measurement	16%	32%	38%	26%
Statistics	16%	18%	14%	20%
Probability	4%	10%	5%	6%
Pattern and Relationships	0%	2%	0%	2%
Pre-Algebra	4%	22%	52%	14%
Algebra	20%	60%	95%	40%
None	2%	0%	0%	1%
Test Preparation	n=41 (71%)	n=12 (21%)	n=3 (5%)	
Numbers and Operations	29%	50%	100%	40%
Geometry/ Measurement	24%	50%	0%	31%
Statistics	20%	50%	33%	29%
Probability	15%	25%	100%	24%
Pattern and Relationships	0%	8%	0%	2%
Pre-Algebra	0%	0%	0%	0%
Algebra	12%	17%	67%	16%
None	0%	0%	0%	0%

Appendix D

Response Type for Mathematics Classroom Activities -- Grade 2

	Number of Response Types Selected					overall
	One	Two	Three	Four	Five	
Instruction	n=124 (40%)	n=100 (33%)	n=41 (13%)	n=22 (7%)	n=14 (5%)	
Multiple Choice/Matching	9%	18%	12%	18%	7%	13%
Short Answer	10	25	39	73	93	29
Numerical Value	48	76	76	96	79	67
Expression	2	5	20	14	14	7
Making a Chart/Table/Graph	14	14	29	55	71	23
Show Your Work	0	11	27	18	14	10
Short Explanation	1	11	39	36	86	18
Long Explanation	2	6	7	9	36	7
Creating/Posing Math Problems	2	1	12	0	14	4
Figural Patterns/Diagrams	5	15	7	27	0	11
Measuring	0	6	12	14	36	7
Modeling/Experiments	1	2	2	0	0	2
Oral	0	6	7	32	14	6
Other*	6	4	10	9	36	8
Assessment	n=85 (38%)	n=69 (31%)	n=39 (17%)	n=22 (10%)	n=7 (3%)	overall
Multiple Choice/Matching	42%	29%	23%	36%	14%	33%
Short Answer	2	19	56	73	71	27
Numerical Value	45	71	82	82	100	65
Expression	1	3	13	5	57	7
Making a Chart/Table/Graph	6	19	33	46	43	20
Show Your Work	0	16	18	32	86	14
Short Explanation	0	15	28	46	43	16
Long Explanation	2	4	5	5	43	5
Creating/Posing Math Problems	1	1	3	5	14	3
Figural Patterns/Diagrams	0	3	13	32	14	7
Measuring	0	4	15	23	14	8
Modeling/Experiments	0	1	3	0	0	1
Oral	0	12	8	9	0	6
Other*	0	2	0	10	0	2

Response Type for Mathematics Classroom Activities -- Grade 3

	Number of Response Types Selected					overall
	One	Two	Three	Four	Five	
Instruction	n=132 (31%)	n=142 (34%)	n=72 (17%)	n=39 (9%)	n=31 (7%)	
Multiple Choice/Matching	9	12	18	5	16	12
Short Answer	9	28	35	41	65	28
Numerical Value	49	68	74	80	87	66
Expression	3	9	8	23	13	10
Making a Chart/Table/Graph	14	22	35	46	52	26
Show Your Work	1	15	28	31	61	18
Short Explanation	2	17	42	69	90	28
Long Explanation	2	4	8	18	39	9
Creating/Posing Math Problems	2	4	11	15	13	7
Figural Patterns/Diagrams	2	9	15	21	23	11
Measuring	0	5	13	21	19	8
Modeling/Experiments	2	0	0	13	0	2
Oral	0	7	11	15	16	7
Other*	5	1	2	3	6	3
Assessment	n=90 (31%)	n=75 (26%)	n=64 (22%)	n=25 (9%)	n=17 (6%)	overall
Multiple Choice/Matching	24	28	23	16	35	27
Short Answer	6	25	33	44	41	27
Numerical Value	51	67	91	88	94	73
Expression	0	3	5	28	29	10
Making a Chart/Table/Graph	8	15	19	32	53	19
Show Your Work	0	7	33	36	59	21
Short Explanation	6	27	47	84	82	37
Long Explanation	1	4	9	16	29	7
Creating/Posing Math Problems	0	1	0	12	18	3
Figural Patterns/Diagrams	1	15	8	16	18	13
Measuring	0	3	9	8	24	8
Modeling/Experiments	0	1	0	4	6	1
Oral	0	1	14	4	6	4
Other*	3	4	9	12	6	7

	Number of Response Types Selected					overall
	One	Two	Three	Four	Five	
Test Preparation	n=3 (8%)	n=2 (5%)	n=12 (31%)	n=13 (33%)	n=5 (13%)	
Multiple Choice/Matching	0	0	8	15	0	8
Short Answer	0	100	17	46	80	46
Numerical Value	100	50	50	62	100	64
Expression	0	0	0	0	0	3
Making a Chart/Table/Graph	0	0	75	62	100	64
Show Your Work	0	0	33	39	60	39
Short Explanation	0	50	67	85	100	69
Long Explanation	0	0	0	39	40	23
Creating/Posing Math Problems	0	0	0	0	0	0
Figural Patterns/Diagrams	0	0	25	39	0	31
Measuring	0	0	17	0	0	5
Modeling/Experiments	0	0	0	0	0	0
Oral	0	0	0	8	0	8
Other*	0	0	8	8	20	13

	Number of Response Types Selected					overall
	One	Two	Three	Four	Five	
Instruction	n=72 (29%)	n=83 (34%)	n=47 (19%)	n=25 (10%)	n=10 (4%)	
Multiple Choice/Matching	10	13	15	24	30	15
Short Answer	4	37	34	68	80	33
Numerical Value	68	71	85	96	100	78
Expression	3	0	6	16	0	5
Making a Chart/Table/Graph	8	16	30	56	50	24
Show Your Work	0	19	21	28	50	16
Short Explanation	0	15	53	56	80	27
Long Explanation	0	6	6	16	20	7
Creating/Posing Math Problems	1	4	6	8	30	6
Figural Patterns/Diagrams	4	10	21	4	10	10
Measuring	0	5	4	12	0	5
Modeling/Experiments	0	0	2	4	10	4
Oral	0	2	4	12	20	5
Other*	1	2	10	0	20	4
Assessment	n=57 (35%)	n=47 (29%)	n=32 (20%)	n=18 (11%)	n=8 (5%)	overall
Multiple Choice/Matching	39	19	56	50	50	38
Short Answer	5	45	59	83	75	40
Numerical Value	49	77	81	94	88	70
Expression	0	2	9	11	25	5
Making a Chart/Table/Graph	4	11	19	28	13	12
Show Your Work	0	17	22	56	63	19
Short Explanation	2	11	31	33	50	16
Long Explanation	0	2	0	11	25	3
Creating/Posing Math Problems	0	2	3	6	13	3
Figural Patterns/Diagrams	0	0	6	17	50	6
Measuring	0	6	6	6	38	6
Modeling/Experiments	0	2	3	0	0	1
Oral	0	4	0	0	13	2
Other*	2	2	3	6	0	2

Response Type for Mathematics Classroom Activities – Grade 5

	Number of Response Types Selected					overall
	One	Two	Three	Four	Five	
Instruction	n=106 (32%)	n=90 (27%)	n=68 (21%)	n=36 (11%)	n=20 (6%)	
Multiple Choice/Matching	9	11	18	17	25	14
Short Answer	7	30	41	50	65	31
Numerical Value	55	81	90	94	90	77
Expression	0	4	9	6	10	5
Making a Chart/Table/Graph	14	14	34	67	80	30
Show Your Work	0	8	21	22	60	13
Short Explanation	7	18	38	78	90	31
Long Explanation	2	4	7	19	40	10
Creating/Posing Math Problems	0	8	12	6	5	6
Figural Patterns/Diagrams	5	9	15	11	10	10
Measuring	0	7	15	14	15	8
Modeling/Experiments	1	0	2	9	5	3
Oral	0	0	0	3	5	1
Other*	1	5	0	6	0	4
Assessment	n=94 (38%)	n=55 (22%)	n=47 (19%)	n=27 (11%)	n=12 (5%)	overall
Multiple Choice/Matching	50	18	32	33	17	35
Short Answer	1	40	47	59	58	32
Numerical Value	30	80	85	96	92	65
Expression	1	2	9	11	33	7
Making a Chart/Table/Graph	6	11	40	33	50	22
Show Your Work	1	13	19	37	50	15
Short Explanation	1	13	36	56	83	25
Long Explanation	3	6	11	4	25	8
Creating/Posing Math Problems	1	6	2	7	0	3
Figural Patterns/Diagrams	1	2	6	37	42	11
Measuring	0	9	11	15	25	8
Modeling/Experiments	0	2	0	0	8	2
Oral	0	0	2	7	17	2
Other*	4	0	0	4	0	3

	Number of Response Types Selected					overall
	One	Two	Three	Four	Five	
Test Preparation	n=7 (25%)	n=2 (7%)	n=5 (18%)	n=7 (25%)	n=4 (14%)	
Multiple Choice/Matching	0	0	0	14	50	11
Short Answer	0	0	20	29	50	29
Numerical Value	14	0	80	86	100	64
Expression	0	0	0	29	25	14
Making a Chart/Table/Graph	14	0	40	57	100	46
Show Your Work	14	0	40	29	50	29
Short Explanation	29	50	80	86	100	71
Long Explanation	29	50	0	43	25	32
Creating/Posing Math Problems	0	0	20	0	0	4
Figural Patterns/Diagrams	0	0	20	0	0	7
Measuring	0	0	0	0	0	4
Modeling/Experiments	0	50	0	0	0	8
Oral	0	0	0	0	0	0
Other*	0	50	0	28	0	15

Response Type for Mathematics Classroom Activities -- Grade 7

	Number of Response Types Selected					overall
	One	Two	Three	Four	Five	
Instruction	n=118 (38%)	n=86 (27%)	n=56 (18%)	n=32 (10%)	n=15 (5%)	
Multiple Choice/Matching	7	5	11	6	13	7
Short Answer	4	31	48	44	67	29
Numerical Value	75	79	93	91	100	82
Expression	3	8	18	6	7	8
Making a Chart/Table/Graph	2	11	18	53	67	17
Show Your Work	0	14	20	34	27	14
Short Explanation	1	21	48	66	87	28
Long Explanation	3	6	11	34	27	11
Creating/Posing Math Problems	1	6	7	9	0	5
Figural Patterns/Diagrams	3	8	0	9	33	6
Measuring	0	9	14	22	47	10
Modeling/Experiments	1	1	2	12	13	4
Oral	0	2	4	9	7	3
Other*	1	0	7	3	7	3
Assessment	n=60 (26%)	n=66 (28%)	n=58 (25%)	n=31 (13%)	n=13 (6%)	overall
Multiple Choice/Matching	27	8	21	36	31	22
Short Answer	2	32	57	58	85	38
Numerical Value	62	89	91	0	100	85
Expression	0	21	28	26	23	19
Making a Chart/Table/Graph	2	6	17	23	23	12
Show Your Work	0	17	40	68	46	28
Short Explanation	2	12	21	42	69	20
Long Explanation	7	0	7	13	54	10
Creating/Posing Math Problems	0	2	3	7	8	3
Figural Patterns/Diagrams	0	2	3	13	23	5
Measuring	0	5	7	7	23	5
Modeling/Experiments	0	0	0	7	8	1
Oral	0	2	2	3	8	2
Other*	0	3	3	0	0	2

Response Type for Mathematics Classroom Activities -- Grade 8

	Number of Response Types Selected					overall
	One	Two	Three	Four	Five	
Instruction	n=112 (35%)	n=85 (27%)	n=59 (18%)	n=33 (10%)	n=26 (8%)	
Multiple Choice/Matching	11	4	12	9	12	9
Short Answer	5	24	42	49	39	25
Numerical Value	71	79	85	91	92	80
Expression	2	13	15	12	27	11
Making a Chart/Table/Graph	1	17	24	52	62	21
Show Your Work	0	27	27	27	50	20
Short Explanation	0	9	51	79	85	29
Long Explanation	5	8	14	33	46	14
Creating/Posing Math Problems	0	1	5	3	0	2
Figural Patterns/Diagrams	3	7	10	24	23	10
Measuring	0	4	14	18	42	10
Modeling/Experiments	0	5	2	0	23	4
Oral	0	2	0	3	0	1
Other*	4	1	0	0	0	2
Assessment	n=66 (28%)	n=71 (30%)	n=44 (19%)	n=33 (14%)	n=14 (6%)	overall
Multiple Choice/Matching	33	1	18	24	43	20
Short Answer	3	18	32	61	93	29
Numerical Value	50	85	86	97	86	77
Expression	2	21	23	15	29	17
Making a Chart/Table/Graph	3	14	25	39	43	21
Show Your Work	0	38	59	36	50	33
Short Explanation	2	9	25	52	64	21
Long Explanation	6	10	18	39	50	18
Creating/Posing Math Problems	0	1	0	6	0	1
Figural Patterns/Diagrams	0	1	9	12	21	6
Measuring	0	0	5	6	7	2
Modeling/Experiments	0	1	0	3	0	1
Oral	0	0	0	9	7	2
Other*	2	0	0	0	7	1

	Number of Response Types Selected					overall
	One	Two	Three	Four	Five	
Test Preparation	n=5 (9%)	n=9 (16%)	n=15 (26%)	n=16 (28%)	n=6 (10%)	
Multiple Choice/Matching	0	0	0	6	0	2
Short Answer	0	10	20	38	100	38
Numerical Value	80	50	87	100	83	85
Expression	0	0	20	13	0	9
Making a Chart/Table/Graph	20	30	33	50	83	48
Show Your Work	0	30	47	31	17	29
Short Explanation	0	0	60	88	83	59
Long Explanation	0	50	27	25	100	41
Creating/Posing Math Problems	0	0	0	0	0	3
Figural Patterns/Diagrams	0	10	0	31	17	14
Measuring	0	0	7	13	0	10
Modeling/Experiments	0	20	0	0	0	8
Oral	0	0	0	6	0	5
Other*	0	0	0	0	17	3

Appendix E

MSPAP-like Levels for Mathematics Classroom Activities -- Grade 2

	Number of Task Types Selected			overall
	One	Two	Three	
Instruction	n=276 (90%)	n=31 (10%)	n=1 (0%)	
Computation/Equation	48	74	100	51
Traditional Word Problems	5	19	0	6
Graph, Table, Model, Pattern, etc.	14	45	100	17
MSPAP-like 1	24	58	100	28
MSPAP-like 2	5	3	0	5
MSPAP-like 3	3	0	0	3
Assessment	n=132 (59%)	n=71 (32%)	n=18 (8%)	overall
Computation/Equation	46	89	94	64
Traditional Word Problems	5	70	100	34
Graph, Table, Model, Pattern, etc.	12	18	28	16
MSPAP-like 1	29	20	78	31
MSPAP-like 2	6	3	0	4
MSPAP-like 3	2	0	0	1

	Number of Task Types Selected			overall
	One	Two	Three	
Instruction	n=364 (86%)	n=49 (12%)	n=9 (2%)	
Computation/Equation	38	78	89	44
Traditional Word Problems	4	53	89	12
Graph, Table, Model, Pattern, etc.	11	14	11	12
MSPAP-like 1	32	47	100	35
MSPAP-like 2	8	8	11	8
MSPAP-like 3	7	0	0	6
Assessment	n=196 (68%)	n=66 (23%)	n=18 (6%)	overall
Computation/Equation	38	82	100	54
Traditional Word Problems	3	67	100	26
Graph, Table, Model, Pattern, etc.	7	8	17	10
MSPAP-like 1	34	39	83	40
MSPAP-like 2	11	5	0	8
MSPAP-like 3	7	0	0	5
Test Preparation (gr. 3, 5, 8)	n=38 (97%)	n=0 (0%)	n=0 (0%)	overall
Computation/Equation	8	0	0	10
Traditional Word Problems	0	0	0	3
Graph, Table, Model, Pattern, etc.	3	0	0	5
MSPAP-like 1	32	0	0	33
MSPAP-like 2	26	0	0	26
MSPAP-like 3	32	0	0	31

	Number of Task Types Selected			overall
	One	Two	Three	
Instruction	n=188 (77%)	n=52 (21%)	n=5 (2%)	
Computation/Equation	40	83	100	50
Traditional Word Problems	7	46	60	17
Graph, Table, Model, Pattern, etc.	8	19	40	11
MSPAP-like 1	35	40	100	38
MSPAP-like 2	8	10	0	8
MSPAP-like 3	1	2	0	1
Assessment	n=93 (57%)	n=47 (29%)	n=21 (13%)	overall
Computation/Equation	55	96	95	72
Traditional Word Problems	9	70	91	38
Graph, Table, Model, Pattern, etc.	7	13	29	12
MSPAP-like 1	26	17	81	31
MSPAP-like 2	1	4	5	3
MSPAP-like 3	2	0	0	1

	Number of Task Types Selected			overall
	One	Two	Three	
Instruction	n=259 (79%)	n=52 (16%)	n=15 (5%)	
Computation/Equation	31	73	100	41
Traditional Word Problems	6	54	73	17
Graph, Table, Model, Pattern, etc.	13	14	40	15
MSPAP-like 1	33	54	80	38
MSPAP-like 2	9	6	0	8
MSPAP-like 3	9	0	7	7
Assessment	n=149 (61%)	n=60 (24%)	n=33 (13%)	overall
Computation/Equation	40	95	100	62
Traditional Word Problems	3	75	97	35
Graph, Table, Model, Pattern, etc.	8	10	21	12
MSPAP-like 1	31	18	79	35
MSPAP-like 2	8	2	3	6
MSPAP-like 3	11	0	0	7
Test Preparation (gr. 3, 5, 8)	n=25 (89%)	n=2 (7%)	n=1 (4%)	overall
Computation/Equation	4	100	0	11
Traditional Word Problems	0	0	100	4
Graph, Table, Model, Pattern, etc.	4	0	1	4
MSPAP-like 1	52	100	100	58
MSPAP-like 2	8	0	100	11
MSPAP-like 3	32	0	0	29

	Number of Task Types Selected			overall
	One	Two	Three	
Instruction	n=268 (85%)	n=43 (14%)	n=4 (1%)	
Computation/Equation	38	84	100	45
Traditional Word Problems	8	58	75	15
Graph, Table, Model, Pattern, etc.	4	21	25	6
MSPAP-like 1	35	35	100	36
MSPAP-like 2	13	2	0	11
MSPAP-like 3	3	0	0	2
Assessment	n=126 (54%)	n=77 (33%)	n=24 (10%)	overall
Computation/Equation	64	96	100	79
Traditional Word Problems	5	58	88	34
Graph, Table, Model, Pattern, etc.	2	9	21	9
MSPAP-like 1	19	34	92	34
MSPAP-like 2	7	3	0	5
MSPAP-like 3	4	0	0	2

MSPAP-like Levels for Mathematics Classroom Activities -- Grade 8

	Number of Task Types Selected			overall
	One	Two	Three	
Instruction	n=262 (82%)	n=51 (16%)	n=7 (2%)	
Computation/Equation	38	80	100	46
Traditional Word Problems	8	55	71	17
Graph, Table, Model, Pattern, etc.	6	14	57	9
MSPAP-like 1	26	39	71	30
MSPAP-like 2	13	12	0	13
MSPAP-like 3	8	0	0	7
Assessment	n=160 (68%)	n=57 (24%)	n=15 (6%)	overall
Computation/Equation	56	90	100	67
Traditional Word Problems	3	61	73	23
Graph, Table, Model, Pattern, etc.	3	21	33	11
MSPAP-like 1	18	25	87	24
MSPAP-like 2	14	4	7	11
MSPAP-like 3	6	0	0	4
Test Preparation (gr. 3, 5, 8)	n=52 (90%)	n=5 (9%)	n=1 (2%)	overall
Computation/Equation	12	100	100	21
Traditional Word Problems	0	20	0	2
Graph, Table, Model, Pattern, etc.	2	0	100	3
MSPAP-like 1	27	80	100	33
MSPAP-like 2	27	0	0	24
MSPAP-like 3	33	0	0	29

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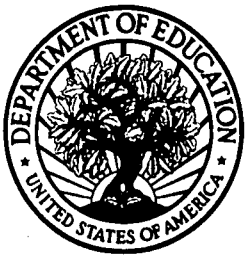

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